ELECTRICAL SOUTH

JUNE
1943

52-In Hotel Type

FANS by HUNTER-CENTURY

55th SEASON

24-In "Airspread" Ceiling

HUNTER, who has made fans and ventilators exclusively during 55 years, is now operating under War Production Board restrictions. • No more fans will be made except for the Army, Navy and Maritime Commission. • HUNTER unfilled orders now on hand represent contracts with Government Agencies. • Certain sizes of belted exhaust types can be made available for Government hospitals and other war industries, subject to limited material inventories now on hand.

HUNTER FAN & VENTILATING COMPANY, INC.

Factory: FULTON, N. Y.

General Sales Offices: Memphis, Sterick Bldg. *Eastern Sales Office*: New York, 92 Warren Street *Western Sales Office*: St. Louis, 1706 Olive Street

Sales Offices:
ATLANTA
CHICAGO
DALLAS
HOUSTON
LOS ANGELES
PHILADELPHIA

Zephair Comfort Cooling and Commercial Ventilators

Sales Offices:
BOSTON
CLEVELAND
DETROIT
KANSAS CITY
NEW ORLEANS
PITTSBURGH

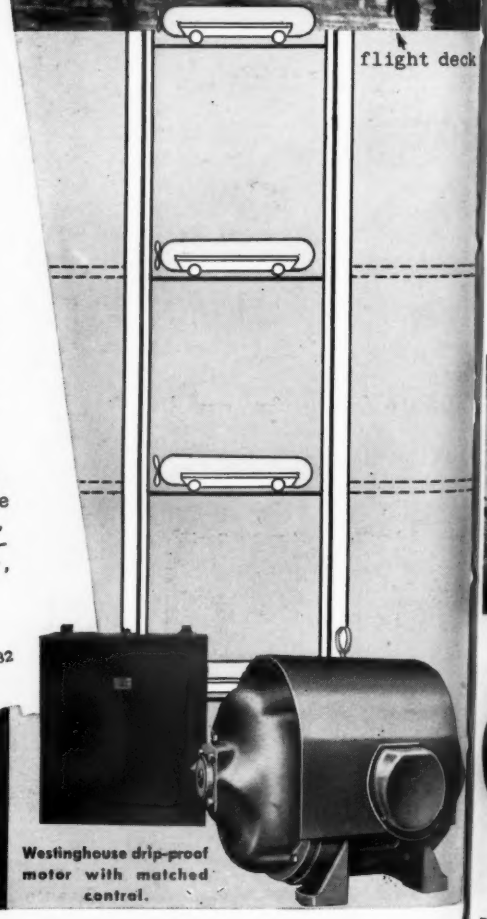
Delivering "FRESH FISH" . . gently . . for Axis breakfasts

"On the alert"—men, machines, and torpedoes function smoothly as one team on board this aircraft carrier. From the depths of the ship a fast-moving elevator lifts a load of deadly "tin fish", bringing its platform to a smooth stop within 1/16-inch of the deck. An important 1/16-inch, because it permits torpedoes to roll directly onto the flight deck without dangerous jarring—or extra, time-consuming handling.

The motor and control which power the elevator work as a team—lifting torpedoes at high speed to the deck and then slowing down gently to a stop "on the nose". To do this, the motor was built with two windings: a high-speed winding for lifting or lowering, and a slow-speed winding for leveling to an accurate stop.

Westinghouse builds many ratings of motors and controls for military and war industry applications. A multitude of these units, like the Westinghouse motor and controls in this elevator, are constructed to withstand the shock and pounding of sea and air battles. For any type of motor, any control . . . on any application . . . call your nearest Westinghouse office.

J-21282



Westinghouse drip-proof motor with matched control.

WESTINGHOUSE

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

MOTORS AND CONTROL

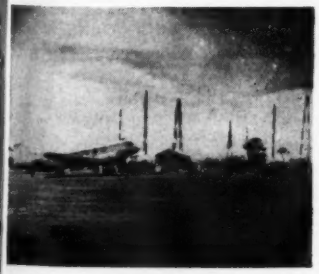
ELECTRICAL SOUTH is published monthly by W. R. C. Smith Publishing Co., Marietta, Ga., and Atlanta, Ga., U. S. A. Subscription rates, United States and Possessions, $1.00 for one year; Canada, $1.50 per year; Foreign Countries, $2.00 per year. Entered as second class matter at the postoffice, Marietta, Ga., under Act of March 3, 1879.

Volume 23 Number 6

Lighting New Skyways for the Americas

WITH remarkable speed the Pan American Airways is completing numerous new airports in Mexico, Central and South America and the West Indies. The forging of this vital chain of airways will have an important part in the conduct of the war. It will assist in smashing Axis strategy.

In the construction of these airports several million feet of cable were used for power, communication, boundary, runway, beacon, landing, flood and search lights. A substantial portion of this cable is HAZASHEATH, a tough, long-lived rubber compound, closely resembling a solid truck tire in its strength and wear-resisting features, and serves both as an insulation and protective covering. It resists moisture, chemicals, heat and rough handling. It eliminates the necessity for lead or other metal coverings and their common troubles such as induced sheath losses, electrolysis, corrosion, crystallization and the lack of flexibility. The rugged HAZASHEATH non-metallic sheath eliminates complicated fibrous coverings, or metal tapes which make splicing a tedious, time-consuming job, requiring expert workmanship.



Photographs courtesy Pan American Airways

HAZASHEATH, because of its high rubber content sheath, is not now available. After the war it will again be available and improved in many ways. In the meantime, and for projects associated with the prosecution of the war, we can supply other Hazard cables, protected with less critical materials, that for years have given meritorious service for airport and street lighting. Ask us for particulars.

The completion of these airports will add another chapter to aviation's history and the important part it is playing in this global war. And later these same airports will become stepping stones that form the post-war highways to commerce and communication between the good neighbors of the Americas.

HAZARD INSULATED WIRE WORKS

DIVISION OF THE OKONITE COMPANY

Wilkes-Barre, Pennsylvania

Offices in Principal Cities

ARMY E NAVY

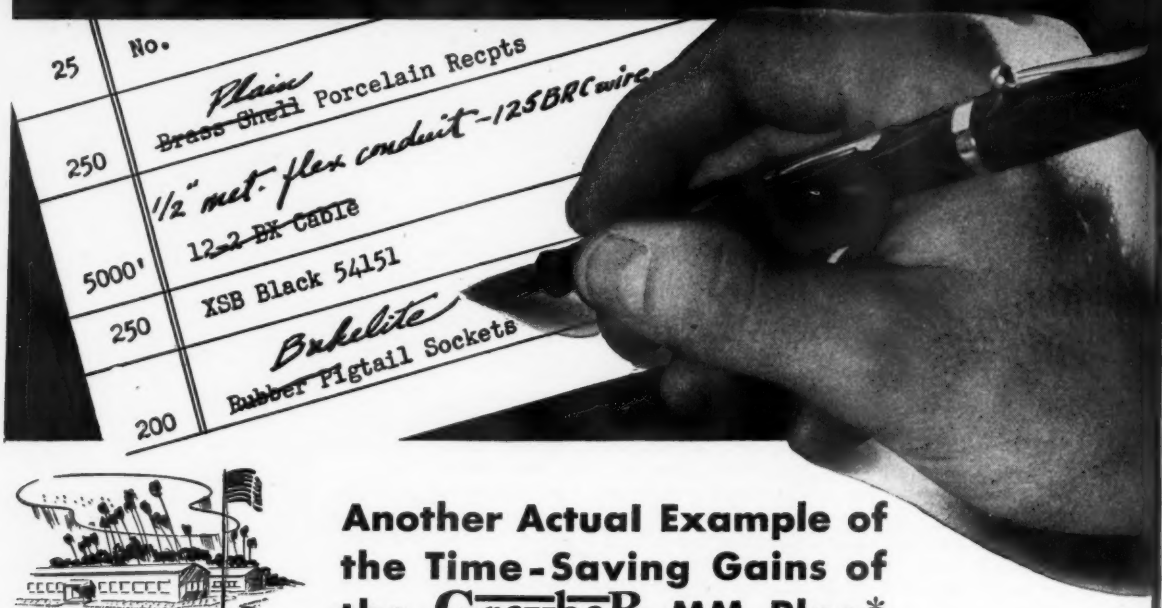
HAZARD

Electrical Wires and Cables

3217

Salvage Your Scrap — Buy U. S. War Bonds

BY FILLING-IN *"Between the Lines"* THE ORDER WENT OUT COMPLETE



Another Actual Example of the Time-Saving Gains of the GraybaR MM Plan*

A CONTRACTOR faced with the job of pushing 150 miles of Central American highway through the jungle had to begin with barracks construction and other basic facilities calling for a wide range of electrical supplies. The sailing date for supply ship from a West Coast port had been set for 8 days hence.

THE BILL OF MATERIALS that was rushed to GRAYBAR showed many items that could only be obtained from the East, and then on 8 to 10 weeks delivery. But GRAYBAR looked at the list realistically. In almost every case, "pinch-hitters" which could be substituted for the missing items were available from GRAYBAR's local warehouses or local sources of supply.

GRAYBAR SPECIALISTS sat down with the contractor's engineers and checked through the list item by item. Porcelain outlet boxes replaced steel, Bakelite pigtail sockets replaced rubber, and so on down th line. Years of experience on wiring supplies, plus up-t the-minute delivery facts, enabled GRAYBAR to build *complete* list for the job that could be shipped on tim

BY FILLING-IN between the lines, the entire shipmen was on board at sailing time. The barracks were sati factorily wired and equipped.

*Serving as your MATERIALS MOBILIZER

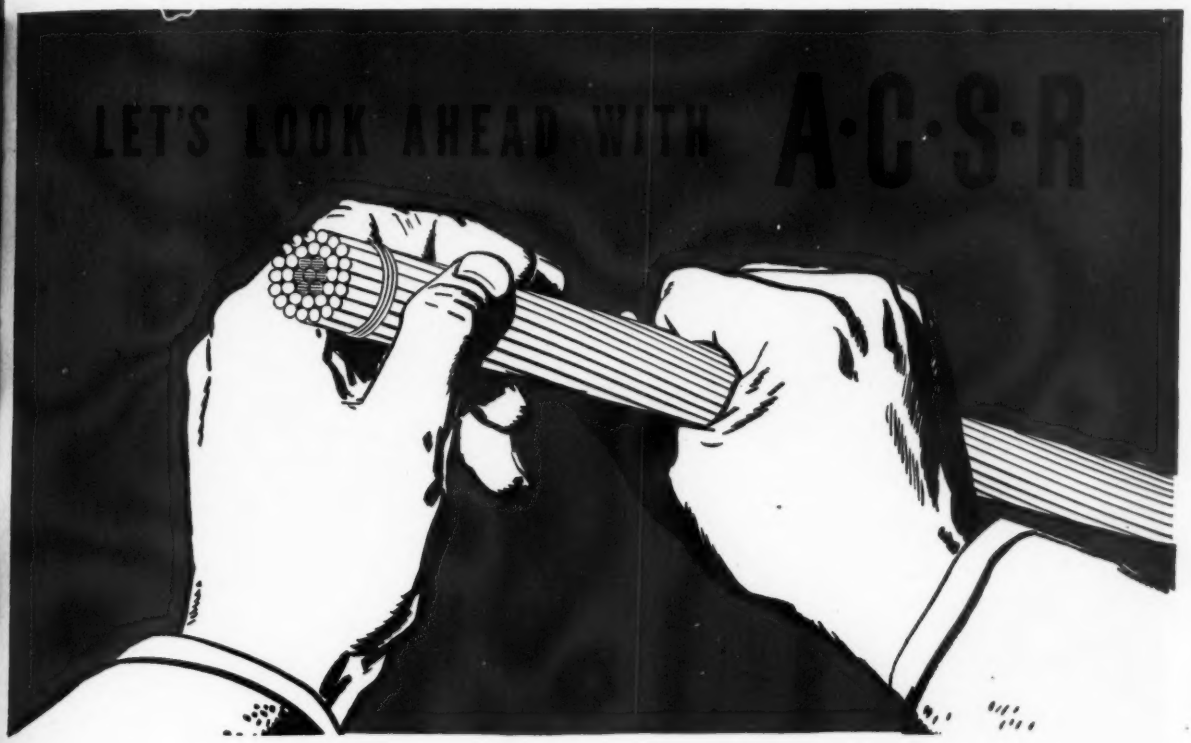
By this GRAYBAR service, your electrical needs are linked to the available output of 200 manufacturers, mobilized locally at more than 80 warehouses. The MM Plan "dovetails" GRAYBAR'S procurement work with your own purchasing requirements. You save time in getting estimates, checking specifications, expediting delivery, locating "hard-to-get" items. Ask your local GRAYBAR Representative how this "one-call" service can help you.

Executive Offices: GRAYBAR BUILDING New York, N. Y.

GraybaR

IN OVER 80 PRINCIPAL CITIES

GraybaR Everything Electrical . . . . THAT IT TAKES TO WIN!

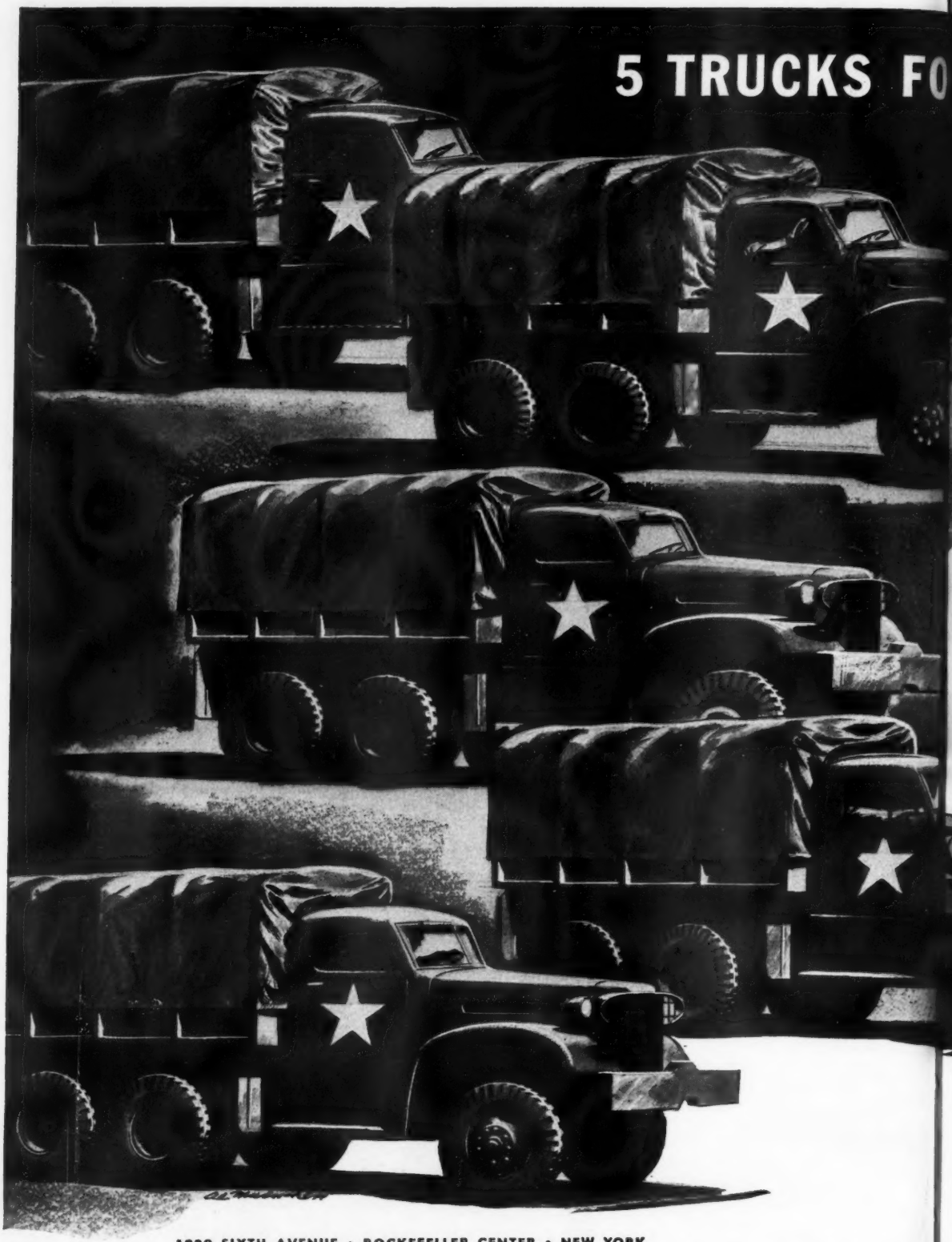


Voltages far above anything transmitted up to now are predicted for power lines of the near future. A fuller realization of the potentialities of electricity will make such superpower lines necessary. And with the development of those lines, an equally interesting future for A.C.S.R. is certain.

Look at the enviable record already established for Aluminum Cable Steel Reinforced: A thirty-year history of successful performance—a million miles bought for the construction of rural lines and hi-lines—some of this conductor has been in service over a quarter of a century. A.C.S.R. lines are carrying a large percentage of the power used by war industries today.

A.C.S.R. owes much of its success to this combination of properties: light weight with high strength and sturdiness, high electrical conductivity, ability to withstand corrosive attack. Too, Alcoa engineering has grown up with the industry, developing stringing standards, accessories, and a perfected system of vibration control, all as demanded by progress.

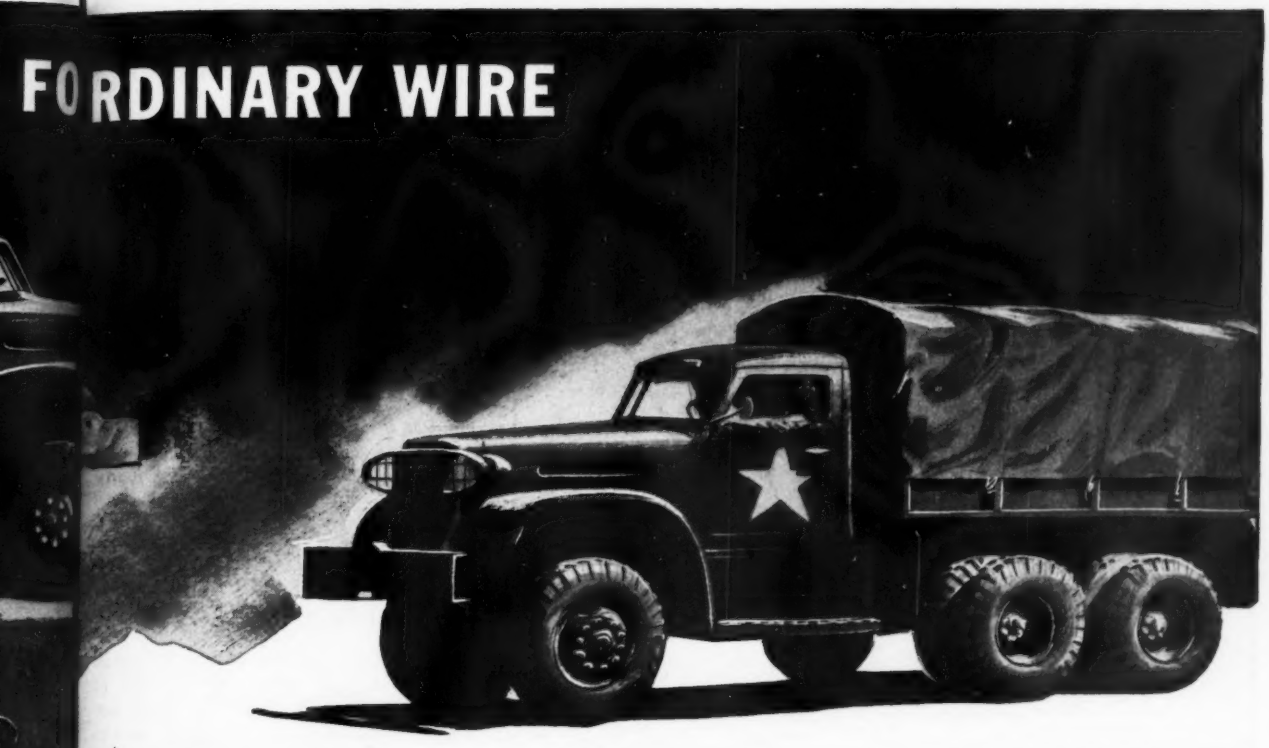
Those postwar, superpower lines will bring new design and construction problems. A.C.S.R. and Alcoa engineering intend to keep abreast of the trend. ALUMINUM COMPANY OF AMERICA, 2164 Gulf Building, Pittsburgh, Pa.



1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK

UNITED STATE

FORDINARY WIRE



TRUCK FOR U.S. Laytex ASSAULT WIRE

REG. U. S. PAT. OFF.

4 TRUCKS RELEASED FOR OTHER MATÉRIEL TRANSPORT

Every day our Armed Forces are in the field, distances from base to front lengthen... problems of transportation increase... every cubic foot of space that can be saved for the S.O.S. is vital.

U. S. Laytex Assault Wire requires only 1/5 the space in transport of ordinary communications wire.

In the unique Laytex Process, the compounded, purified latex is applied to the electrical conductor by dipping. Conductors are perfectly centered and the weight of the insulation and the diameter of the insulated conductor are kept at the minimum.

Lightweight and small bulk are only two advantages of U. S. Laytex Assault Wire. It resists concussion and a wide range of temperature changes. Laytex is waterproof and extremely flexible.

Laytex Assault Wire weighs less than 30 lbs. per mile... a mighty important feature when men are marching with full equipment. It has a talking distance of five miles and a breaking strength of 50 lbs. per conductor.

UNITED STATES RUBBER COMPANY · TRADE MARK ·

RUBBER COMPANY

OVER 36 UTILITIES

are using the PM plan to spearhead service campaigns

Introduced a short time ago, Anaconda's Preventive Maintenance Plan is being widely used by utilities to help customers keep electrical systems operating *efficiently*—despite shortages in essential wiring equipment.

Already some 36 utilities are actively engaged in this program. With it, they are helping their industrial power customers maintain continuous wartime production by preventing electrical breakdowns.

1 WHAT THE PLAN IS

The PM plan is a simple but comprehensive way to safeguard war production by preventing electrical breakdowns *before they develop.*

2 HOW IT WORKS

The plan provides a practical means of making periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

Data thus gathered aids local W.P.B. Branches in reaching decisions on requests for materials to *prevent* breakdowns.

3 HOW UTILITIES BENEFIT

The PM plan helps utilities maintain close customer contact despite a lack of "something to sell." Offers basis for service campaign that definitely appeals to customers. Puts the utility in a leadership role for furthering war production throughout the area it serves.

If you aren't already utilizing the Anaconda Preventive Maintenance Plan, mail the coupon for full details. 48220

"Tomorrow may be too late . . . do it today!"

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

ANACONDA

Anaconda Wire & Cable Company
25 Broadway, New York City

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding wartime production.

Individual .....

Company .....

Address ..... City .....

631

JUNE, 1943

Volume 23 No. 6

ELECTRICAL SOUTH

J. C. MARTIN,
Manager

W. E. COOGLER,
Production Manager

Editorial and Business Offices
GRANT BUILDING
ATLANTA, GEORGIA

Member of A. B. P.
Member of A. B. C.

ANNUAL SUBSCRIPTION—$1.00
THREE YEARS—$2.00
CANADA—$1.50 FOREIGN—$2.00

Business Representatives:
L. E. ALLEN, 189 West Madison St., Chicago, Ill. Tel.: Lakeview 10282.
L. R. MCCARTY, 325 Winding Way, Merion, Pa. Tel.: Merion 1066.
W. A. MCGEE, P. O. Box 562, Charlotte, N. C. Tel.: 8-4932.

Published Monthly by
W. R. C. SMITH
PUBLISHING CO.
Marietta and Atlanta, Ga.

W. J. ROOKE, *President*
T. W. MCALLISTER, *Vice-President and Editorial Director,*
E. W. O'BRIEN, *Vice-President,*
R. W. PHILIP, *Vice-President,*
RICHARD P. SMITH, *Vice-President,*
O. A. SHARPLESS, *Treasurer,*
J. C. MARTIN, *Secretary.*

Publishers Also of
COTTON
SOUTHERN HARDWARE
SOUTHERN AUTOMOTIVE JOURNAL
SOUTHERN POWER AND INDUSTRY

T. W. McALLISTER, Editorial Director CARL W. EVANS, Editor
NAT M. JOHNSON, Southwestern Editor

Contents

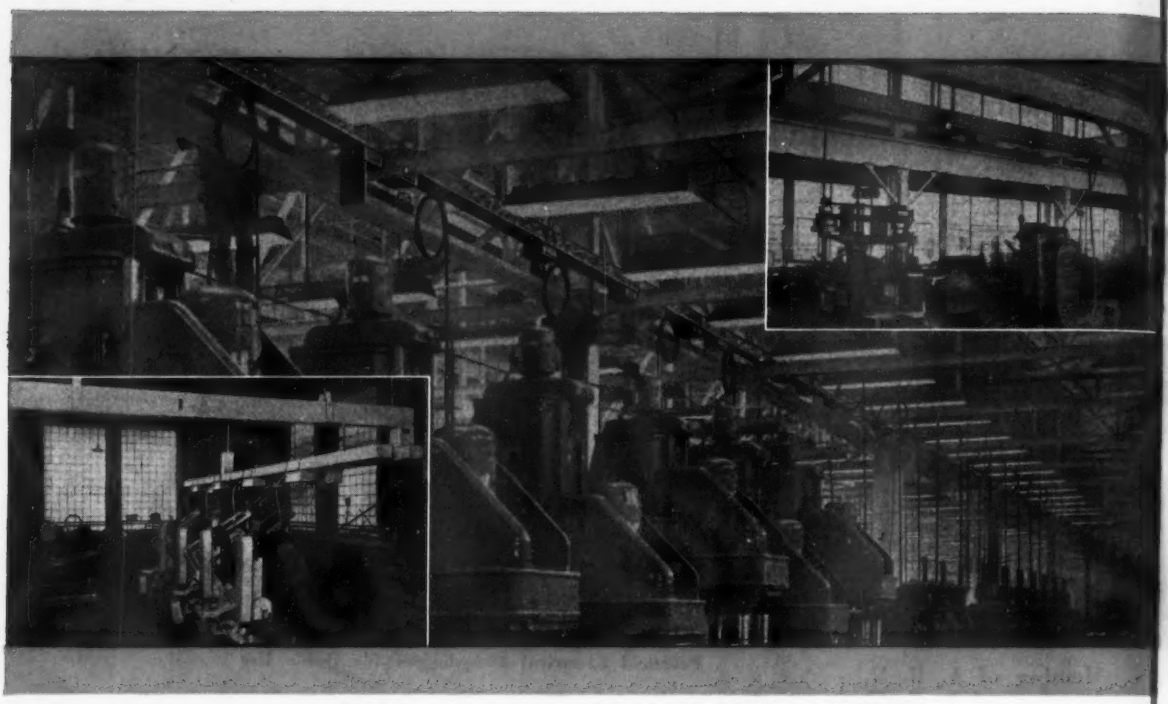
Insulation Maintenance Resistance Tests	9
Practical Electrical Dehydrators for Home Use	13
Marine Electrical Work New Field for Contractors	17
Educational and Service Booths Meet Customer Needs	18
What About Post-war Appliance Models?	20
Servicing Refrigerator High Side Floats	22
Improving Production Efficiency in Motor Shops	26
Reconnecting Three-phase Motors for New Voltages	28

Departments

Practical Helps for the Trade	30
News of the Electrical Industry	34
Personal Notes About Men You Know	46
New Electrical Equipment and Materials	48

Copyrighted 1943, W. R. C. Smith Publishing Co., Atlanta, Ga.

Entered as second class matter at Marietta, Ga., U. S. A., under Act of March 3, 1879.



Ease the Man-power Problem *with*

FA BUSDUCT

The time saved when machines are moved to new positions means labor saved. Connections are quickly made to the conveniently placed outlets—and the machine is in service again with a minimum loss of production time . . . FA Busduct provides a complete duct system of distribution for light, heat and power. It forms a very flexible distribution system. Standard sections are 10 feet long. These, with pull boxes, elbows, end closures, tees and crosses, make it possible to fit any desired arrangement . . . Many plants engaged in war production are speeded up through the use of FA Busduct. Some of these plants are large—some small. Some are of new construction—some have been revamped and modernized. FA Busduct system fits all types with equal facility. It is the *modern* method for the distribution of current . . . Both Feeder and Plugin FA Busduct may be installed with minimum labor cost, and may be taken down and moved to new locations without appreciable loss of material . . . Designed for 2, 3 and 4 wire feeder systems; 25 volts DC, 575 volts AC, maximum. Plugin type capacities, 125 to 1,000 amperes; Feeder type, 250 amperes and up. Fully approved by Underwriters' Laboratories, Inc.

Use the Experience of the FA Sales-Engineer
in planning and designing an efficient and convenient FA Busduct distribution system. No obligation, of course. Write for name and address of the one nearest you. Bulletin 65 gives details . . . It will be sent promptly on request . . . Frank Adam Electric Co., St. Louis, Mo.

P.S.: On special order, "Conservation Type" FA Busduct, using a minimum of critical copper and steel, to meet W. P. B. requirements, is available.

EST. 1891 — THE SIGN OF A BETTER JOB
Frank Adam
ELECTRICAL PRODUCTS
for War Industry
FRANK ADAM ELECTRIC CO.
ST. LOUIS, MO. U.S.A.

Insulation Resistance Tests

The life of any motor or generator is in its winding insulation. A good understanding of insulation resistance tests and their significance is needed by every maintenance man.

By E. S. Lammers*

MANY ARTICLES have been written on the subject of maintenance schedules. Systematic maintenance requires some form of a schedule and a system of records. Maintenance is blind and haphazard without accurate records, and much is to be learned from records by comparison; and the older the records, the more valuable they become, by virtue of this comparison with previous tests and inspections.

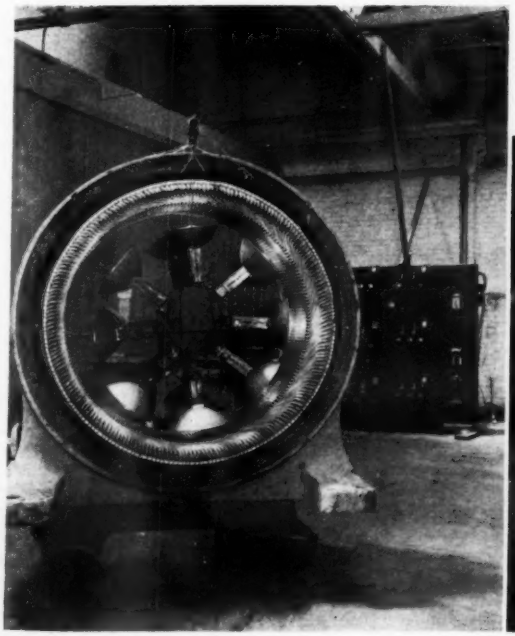
In one plant a log book is kept in the electric shop and each electrician writes down every call and every detail done, and if a regular inspection is made, a detailed report is turned in to the chief, who in turn has these details carefully recorded in a loose-leaf system, or a card index system. Naturally there must be some form of a tickler system to every set of records, so that automatically there is a reminder of when the next inspection is due.

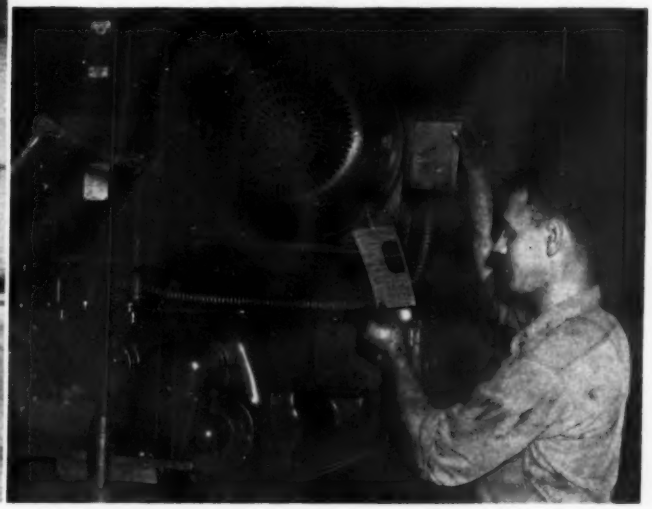
The most vulnerable part of a squirrel cage motor is the stator winding. The life of the winding is in its insulation. While it is true that the electron theories have upset the old ideas that electricity flows, yet the old analogy of the flow of water in a pipe still serves to illustrate the importance of the insulation. The insulation is to the conduction of electricity, what the pipe is to the conduction of water, except that if there is a leak in the water pipe the losses are increased, but complete failure does not necessarily result.

In the case of a leak through the insulation of an electrical conductor, however, complete failure quickly develops. The insulation of the motor windings must therefore be preserved from any leaks. Of course, it can be argued that every type of insulation has what is known as a dielectric loss, and what is here meant as a "leak" is a concentration of this leakage loss that reduces the resistance to ground below recognized safe values. It is by the measure of the insulation resistance, that the measure of its sufficiency or condition is obtained.

Unfortunately, the true measure of the insulation is by potential tests that are destructive and the only practical non-destructive means of determining the operating condition of the insulation is by measuring its resistance and the most commonly accepted method is by use of the megger. (*Please see footnote on page 10.*) The megger is recommended to all operating men, but attention is directed to the fact that the reading in itself does not indicate the actual condi-

*Mr. Lammers is industrial application engineer with the Westinghouse Electric & Mfg. Co. This article is adapted from an address presented before a joint meeting of the Georgia Sections, AIEE and IAEI, in Atlanta, May 3 and 4, 1943.





(Below) Important to any maintenance schedule is correct maintenance information on every piece of equipment. The best plan is to maintain a file on manufacturers data. (Left) Infra-red heating lamps provide a flexible means of drying out motors and generators when too much moisture has been absorbed by the windings.

PLANT NO. _____ MACHINE NO. _____ INVENTORY NO. _____ MOTOR NO. _____

H. P. _____ MANUFACTURED BY _____

SHUNT SERIES COMPOUND SYNCHRONOUS INDUCTION

TYPE FRAME SPEED VOLTS PHASE CYCLES

MODEL FORM STYLE OR S. O. NO. SERIAL NO.

MFGRS. ORDER NO. OUR ORDER NO. DATE

CONNECTION DIAGRAM ROTOR OR ARM. STATOR

SPECIFICATION	BEARINGS	SHAFT EXTENSION	PULLEY	GEAR	V BELT DRIVE
OPEN ☐	SLEEVE ☐	DIA. _____	DIA. _____	TEETH _____	NO. GROOVES _____
EXPL. PROOF ☐	BALL ☐	LENGTH _____	FACE _____	PITCH _____	PITCH DIA. _____
DRIP PROOF ☐	ROLLER ☐	KEYWAY _____		FACE _____	BELT SECTION
TOTALLY ENCL. ☐					☐ A - 1/2 X 11/32
VERTICAL ☐					☐ B - 21/32 X 7/16
_____ ☐					☐ C - 7/8 X 17/32
					☐ D - 1-1/4 X 3/4

MOTOR SERVICE RECORD

DATE INSTALLED	LOCATION	APPLICATION

DATE REPAIRED	REPAIRS OR PARTS REPLACED	CAUSE	REPAIRED BY	TOTAL COST

MOTOR SERVICE RECORD FORM 18221 WESTINGHOUSE ELEC. & MFG. CO. — MAINTENANCE DEPT.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
MAINTENANCE DEPT.

RENEWAL PARTS PUBLICATION NO _____

NAME OF PART	NO. PER MOTOR	STYLE NO.	PARTS PURCHASED					
			DATE	QUAN.	TOTAL COST	DATE	QUAN.	TOTAL COST
ROTOR OR ARM COILS								
STATOR COILS								
FIELD COILS - SHUNT								
FIELD COILS - SERIES								
FIELD COILS - COMM.								
ASSEM. SEG. OR COLL. RINGS								
BRUSHES								
BRUSHHOLDERS								
BRUSHHOLDER SPRINGS								
BRUSHHOLDER FINGERS								
BEARING - FRONT								
BEARING - REAR								
OIL RING - FRONT								
OIL RING - REAR								

STARTER

CLASS	H. P.	STYLE OR S. O.	REMARKS

MOTOR SERVICE RECORD FORM 18221 BACK

Accurate and complete maintenance records are necessary if all of the advantages of good maintenance are to be obtained. At left is a suggested card form, front and back, which provides ample space for all necessary entries.

tion of the winding unless it is properly analyzed.

For example, a low megohm reading does not necessarily indicate poor insulation, for it can be due entirely to a surface condition. If a low megohm reading is obtained, then the motor should be isolated from its control, and the leads examined carefully, to make sure that there is no point where there is a low surface leakage to ground. A dirty winding contributes greatly to the surface leakage, irrespective of the amount of moisture that may be absorbed by the insulation.

Assume that the motor is relatively clean; then a low megger reading indicates moisture absorption by the insulation. It is surprising how quickly, a winding can absorb moisture to produce a low megger reading, merely from humid conditions of the atmosphere. The large paper plants along the coast, on both the Atlantic Seaboard and the Gulf Coast, have had considerable experience with maintenance problems, caused by high humidity.

When the motor is operating, the winding is kept warm by its own losses, which in turn gives self-protection against excessive moisture absorption under high humid conditions, but this ceases when the motor is shut down. Even with a 24 hour shut-down, a good clean motor can have its insulation resistance reduced to an unsafe value by moisture absorption from the atmosphere.

This must be watched particularly in the rainy seasons, and it is doubly important in connection with 2200 volt motors, in comparison with 440 or 550 volt motors. Some of the paper plants have experienced 10 to 12 serious winding failures on large and important motors in the first hour of resumed operation after a 48 hour shut-down, as a result of this one thing—moisture absorption from the atmosphere during wet weather or high humid conditions.

Every one of these plants along the coastal area has found it absolutely essential to make insulation tests on all of their 2200 volt motors, after a shut-down before putting them on the line again. I know of one plant that has rigged up a small portable transformer and applies 1/10 operating voltage to the busses of the various load centers, to keep the motors on essential operations warm during a shut-down, to prevent moisture absorption.

Using Internal Heat

The use of internal heat is a very good way to dry out squirrel cage motors. It requires a means of circulating current from a low voltage alternating current source, and approximately 1/10 voltage is a good value to use. It is questionable whether 1/10 voltage will dry out a real wet motor, but it will be sufficient to keep the winding warm. The application of a low alternating current voltage is not recommended for synchronous motors because of the induced currents in the damper bar, and induced voltage in the shunt field coils. It is best to apply direct current to the stator winding of a synchronous motor in order to dry it with internal circulating current.

*The author uses the term "megger" in a general sense referring to an instrument used for measuring resistance in megohms. Attention is directed to the fact that the term "Megger" is a registered trademark. "Meggers" are made in this country by James G. Biddle Co., of Philadelphia. In addition to the Megger insulation tester, the Biddle company makes a Megger ground resistance test and a "Ducter" low resistance ohmeter. The latter is battery operated and reads down as low as .0000001 ohm; it is especially useful for checking switch and circuit-breaker contact resistance, soldered joints, fuses, etc.

Instruments for measuring megohm resistance are manufactured also by the Herman H. Sticht Co., Inc., of New York City. The trade name of their insulation tester is the "Megohmer." This company also makes a "Ground-Ohmer" for ground resistance measurements.

If a separate motor generator set is used for bus excitation for a group of synchronous motors, there will be sufficient d-c power for this purpose, and the voltage can be lowered for this purpose. I have found that on a 2200 volt winding approximately 75 volts d-c is required to dry out the winding. In this case, the synchronous motor stator winding read considerably less than one megohm, and it was thought best to bring it up to 2 meghoms before putting it on the line. The 75 volts d-c was placed across just one phase of the primary and left on for a half a day or more, until the insulation resistance came up to two megohms and better. Where there is no available supply of d-c voltage for drying purposes, a welding set can be used for this purpose.

Grid Heaters Sometimes Used

In the case of large machines having a pit, electric grid heaters can be placed in the bottom of the pit, and a tarpaulin placed over the motor with a small vent hole at the top to let out gasses. Or instead of a grid heater in the bottom of the pit, space heaters can be placed around the motor with a tarpaulin placed over the unit as a whole to keep the heat in with a small vent for the gasses. This method has been used extensively and is known as drying with external heat.

Experience indicates that generally the insulation of large vertical machines may be dried satisfactorily by allowing 2½ to 3 watts per sq. ft. of the outside cylindrical area of the stator punchings assembled, per degree Centigrade rise required. Thus the cylindrical area of the stator punchings times 2-1/2 watts times the degrees rise C. divided by 1,000 gives the kilowatts in space heaters required for the drying operation.

Infra-red drying lamps are beginning to be used more and more for drying out operations, where they are available. In the case of small motors a battery of lamps are placed radially around the motor and the winding brought up to temperature without any attempt to house the stator in and conserve the heat.

In the case of large motors, a housing is most generally used around the motor to conserve the drying heat. Tarpaulins are considered dangerous by some maintenance men in that they ignite easily, particularly at high temperatures, and they prefer to build a temporary box enclosure around the motor to be dried, and line it with sheet asbestos. In every case, the ultimate temperature of the winding must be watched carefully during the drying out procedure.

Temperature affects the insulation resistance readings to a very large extent. A motor that shows 10 megohms at a temperature of 20° C. would show only 80,000 ohms at 80° C. Therefore an insulation resistance reading without its corresponding temperature is absolutely valueless.

For example, an operator might consider it safe to put a motor on the line reading 1 megohm, but if this reading was taken at 20° C., then at 75° C. the resistance reading would be less than 10 000 ohms. In the case of new motors, where the insulation is clean and dry, the insulation resistance could easily read infinity, and even under maximum operating temperatures, it would not read less than 100 megohms. It can be seen from this that the insulation resistance decreases rapidly with the temperature of the winding.

It is recommended by the American Institute of Electrical Engineers that the insulation resistance of stator windings and armatures of clean dry machines at approximately 75° C. should not usually be less than that given by this formula:

$$\text{Insulation Resistance in Megohms} = \frac{\text{Rated Voltage of Machine}}{\frac{\text{Rating in Kva}}{100}} + 1{,}000$$

It can be seen from this formula that except for extremely large machines the insulation resistance would be approximately 1 megohm

Proper tools are essential to any adequate maintenance program. An industrial analyzer and several thermometers should be available.

per 1,000 volts. It is the general practice of insurance companies, accordingly, to demand an insulation resistance of 1 megohm per 1,000 volts. The plotted curve between insulation resistance in megohms and the temperature of the winding is of an exponential nature, and one cannot give a simple expression for interpolating the readings from one temperature to another. In general, however, the insulation resistance measured at 75° C. should increase approximately 50-60 times at a normal room temperature of 25° C. (77° F.). With reference to shunt field windings, either for d-c motors or a-c synchronous motors, the minimum insulation resistance should be of the order of ½ to 1 megohm, depending on the size of the machine. Wherever in doubt, it is best to bring the insulation resistance up to safe values by drying the motor out by any of the methods suggested, before putting the motor on the line.

New Motors Not Immune

Keep in mind that brand new windings will absorb moisture and must be dried out before being put into service. The rapidity with which moisture is absorbed depends on the protection given to the winding by the dipping and baking treatment used for that purpose. Therefore a new motor will absorb moisture less rapidly than an old motor.

The protective coating of varnishes wears down and becomes thin with the motor in service, and this can be attributed to several things. For example, the air flow over the windings used for cooling the machine, either self-ventilated or forced ventilated, can carry a certain amount of abrasive dust in the air which will, in time, wear the protective varnish coatings down to a very thin layer. Accordingly, the motor absorbs moisture more quickly as this protective coating becomes thinner.

A large industrial plant in North Carolina had a 25 hp motor, 550 volts, three-phase, 60 cycles, squirrel cage type, operating a large blower in connection with air conditioning. An appreciable percentage of the air input to the fan passed over this motor. The motor operated exceptionally cool. The fan room was very dry and clean and yet this motor failed after about five years of service.

The electricians in charge seemed very much surprised that this motor, of all of the motors in their plant, should be the one to fail. It was pointed out that the added volume of air passing over this motor was shortening its life by wearing down the protective coating that much more rapidly. The winding absorbed moisture much more rapidly, and over a shut-down period during their rainy season, the insulation resistance did get too low, and the motor failed when put back into service. Accordingly, the longer the motor has been in service, the more frequently the insulation must be checked, particularly after shut-down periods.

From inspection records, it can be easily determined just when the stator windings should be retreated with varnish to decrease this moisture absorption. The life of the insulation can be greatly extended and safe-guarded by periodic treatment of insulating varnishes.

There is a belief that where motors are totally enclosed, the windings are fully protected against all conditions. A totally-enclosed motor can be subject, actually, to more severe moisture conditions, as a result of internal sweating or condensation, than a drip-proof, splash-proof motor.

When totally-enclosed, fan-cooled motors first made their appearance, a number of operators were surprised to find, on opening these motors after a certain length of operation, a pint or more of water in the bottom of the housings. This led to the demand for weep-holes in the bottom of the frames of totally-enclosed fan-cooled motors on the part of some operators.

Every motor will breathe through its bearings and along the motor shaft. When the motor is shut down and cools off, cool air will be sucked in in a reverse manner. Depending on the duty cycle, excess moisture can collect within the motor by this inhaling and exhaling process.

It is evident that this accumulation of moisture within the motor is the result of condensation and that this condensation settles on the motor windings. It is necessary that totally-enclosed motors be better treated against moisture conditions than either general purpose motors or splash-proof, weather-proof motors.

In recent years, there has been a fallacy in the use of totally-enclosed, fan-cooled motors as a protection against moisture conditions. Totally-enclosed, fan-cooled motors should primarily be used only where the atmosphere itself is chemically injurious to the insulation materials. In all other cases, the splash-proof, weather-proof type of motor is not only cheaper but better suited for moisture conditions or where operators are apt to splash motors with a hose in the course of cleaning-up operations.

Dry Dust Not Injurious

In this connection, it should also be pointed out that dry dust is not injurious as a rule to insulation. It is only when this dust becomes dampened, either by moisture or by oil or grease, that it begins to become injurious to the insulation. Wet or oily dust produces a chemical reaction by oxidizing processes that eventually breaks down the insulation resistance.

In a cement plant, the dust will actually set up and protect the windings, but in other mills the dust does not set up and forms a paste which is very injurious to the insulation. Where this condition exists, the windings must be periodically cleaned and dried. Extra dippings and bakings of varnish treatment will materially help under these conditions and extend the cleaning operations over longer intervals. The point is not so much to keep the motors free from dry dust, as to keep the windings clean from wet dust and pasty accumulations. Bearings that leak oil or throw off oil or vapor contribute to these pasty accumulations on the windings and make it necessary to service these motors more frequently.

This discussion on insulation would not be complete without a brief review of the temperature limitations. The fact that a motor runs cool does not necessarily indicate that the insulation will last longer. It is only when the temperature exceeds a critical value that deterioration of the insulation material begins. The safe operating temperature of a motor does not depend on the observable temperature, but on the hottest spot temperature to which the insulation may be subjected. The hot spot temperatures can only be determined by embedded thermo-

(Continued on page 59)

Practical Electrical Dehydrators For Home and Community Use

By Warner Ogden

WARTIME has developed new home and community electric dehydrators, with indications that electrical men in the South will have increasing calls for making and servicing them.

Details on how to build and operate them are now available from research workers after months of experimental work, mostly in Tennessee and Georgia.

National interest has been indicated in extensive tests conducted by agricultural engineers of the Tennessee Valley Authority, Knoxville, in cooperation with the University of Tennessee Agricultural Experiment Station and the Georgia Agricultural Experiment Station. The Georgia State Board of Vocational Education cooperated in much of the work too.

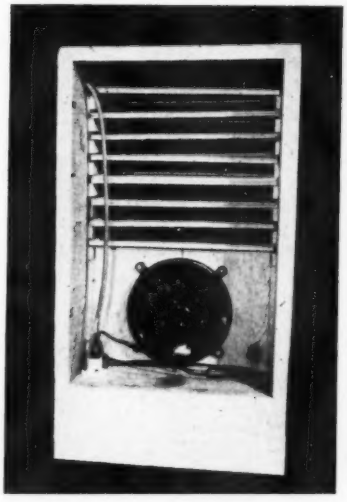
Inquiries from all over the United States poured into Knoxville at the rate of a hundred a day, following recent announcement of new models. Fame of the new electric dehydrators spread to India and to Hawaii. Nationally known firms made models for tryouts.

Groups of agricultural workers attended Home and Community Food Dehydration Schools conducted in Knoxville. Alabama, Mississippi, Florida, South Carolina, Georgia, Tennessee, Kentucky, Virginia and North Carolina were represented.

These agricultural workers went back to their states to tell how, through dehydration, tons of steel normally used in canning operations, could be saved.

They were prepared to tell the people they serve how to properly process foods, how to build and operate an electric dehydrator.

Many of the states arranged to issue bulletins on dehydration, which will be free to the residents of those states. The University of Tennessee Agricultural Experiment Station, which had 2,400 requests just from within Tennessee, rushed publication of a 22-page booklet on dehydration of fruits and vegetables in the home, prepared by Dr. G. A. Shuey, head of the general chemistry department. Georgia Experiment Station, of the University System of Georgia, issued a 35-page booklet on the same subject, prepared by J. G. Woodroof, W. E. DuPree and Helen H. Thompson.

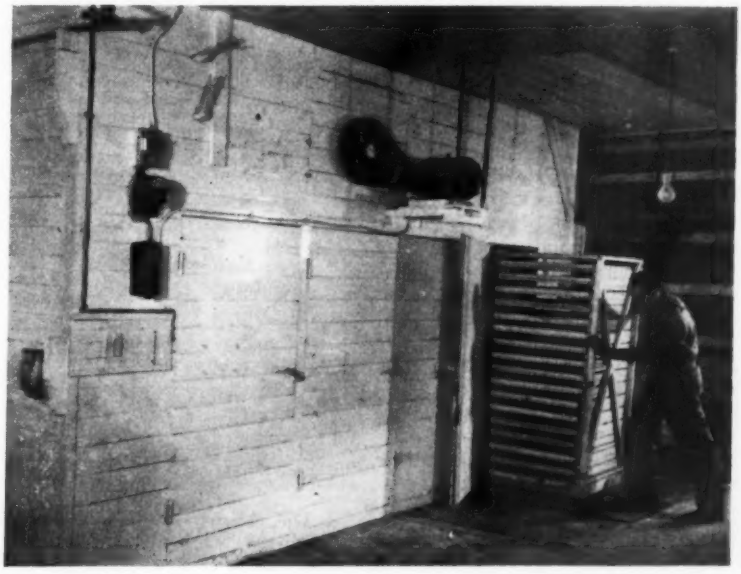


Above, one of the new home type dehydrators. Below, a community dehydrator in operation at Clarksville, Georgia.

TVA sent to agricultural workers, who attended the schools, full details of the research and is also cooperating with states on dehydration.

P. D. Rodgers, assistant agricultural engineer of TVA, whose work on home electric dehydrators is becoming nationally known, said there are several acceptable materials from which a cabinet can be made. Plywood probably is the best for exteriors because it presents a smooth appearance and is easily worked. Tongue-and-groove lumber may be used too, but is rather heavy for the small units which would be moved about more than the larger ones. Compressed fiber wallboard can be used to form the walls, provided a wood frame is attached all around so the corners can be fastened together.

A substantial saving of power can be obtained by moderate insulation of the cabinet walls. This may be done by making the walls double thickness with an air space between the two panels. For added insulation this air space can be filled with sawdust, shavings, excelsior, corrugated cardboard, insulating wallboard, or any com-



Home service advisers of the Arkansas Power & Light Co. shown with home-made dehydrating unit. This picture was taken at a dehydration training school which preceded the Company's home dehydration demonstration program.

mercial material like mineral wool.

Another suitable wall panel can be made by using a single thickness of any of the first-mentioned materials to make the cabinet and then lining it on the inside with some form of fiber board.

Trays can be solid, slatted, or screened bottoms. The solid one has one drawback in that it requires more drying time than either slats or screens. Slatted and screened trays have several drawbacks. They are harder to build; difficult to clean. The slats must be covered with cloth when small pieces as beans or peas are dried. When screen is used, fruit has to be placed on other trays for a sulphur treatment. Even then the screen will eventually darken from the effects of the sulphur dioxide gas in the fruit uniting with the atmospheric moisture in the dehydrator to form sulphurous acid. Apparently, solid-bottom trays are the best all-around.

Mr. Rodgers and others worked only with electric elements in the home dehydrators. They found that cone elements are one of the best types of heater. Cone elements can be obtained in low-temperature types which do not cause excessive localized temperatures, and can be mounted in standard porcelain sockets. Nichrome wire in long coils can be stretched around some kind of mounting posts to form almost any size and shape of element desired. Such an element requires more labor for installation.

Another very convenient and easily obtainable form of heater is the ordinary light bulb. This can be obtained easily, the cost is low, and the mounting is simple.

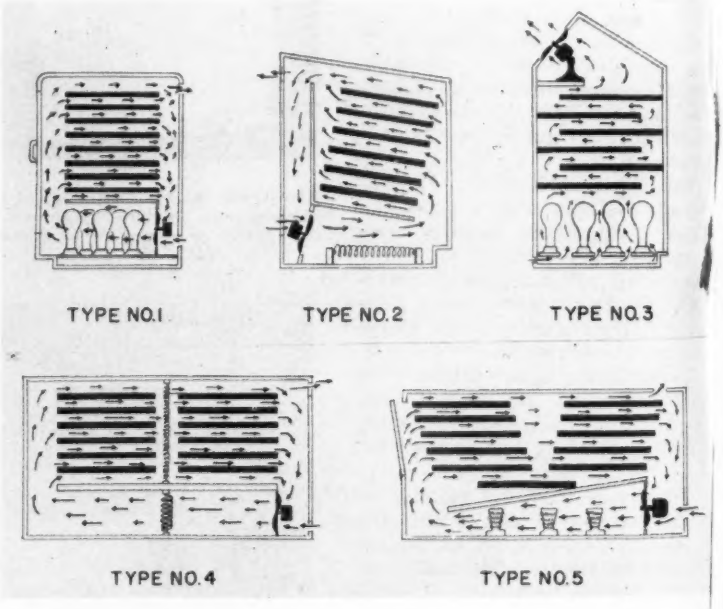
For those wanting to wind their own nichrome wire elements, Mr. Rodgers sketched the method briefly.

"Suppose you wish to make a coil of 1,000 watts for a 115-volt circuit and you have some wire or can obtain it. First, you must determine how much wire is needed. The more wire used the less heat will be produced. Perhaps the container states that the wire has a resistance of 1 ohm per foot. The length of wire is found in this manner. Divide the watts by the volts to find the amperes needed. In the above example, divide 1,000 by 115 to get 8.7 amperes. If you will divide the voltage by the current or 115 by 8.7 you will get 13.2 or the ohms resistance needed. If one foot of wire has one ohm resistance, 13 feet will have 13 ohms, so our coil should be made of a piece of wire 13 feet long.

"Since the resistance increases when the wire gets hotter, the coil would produce somewhat less than 1,000 watts. Now suppose the available wire has such a resistance that 3 feet of wire would make a 1,000-watt coil. If you tried this coil you would find that the surface temperature would be very high since only a small area would be emitting 3415 Btu's every hour. If you would then make the coil 9 feet long it would be cooler but have only one-third as much wattage, so you would put 3 of these coils in parallel to obtain 1,000 watts and a lower temperature.

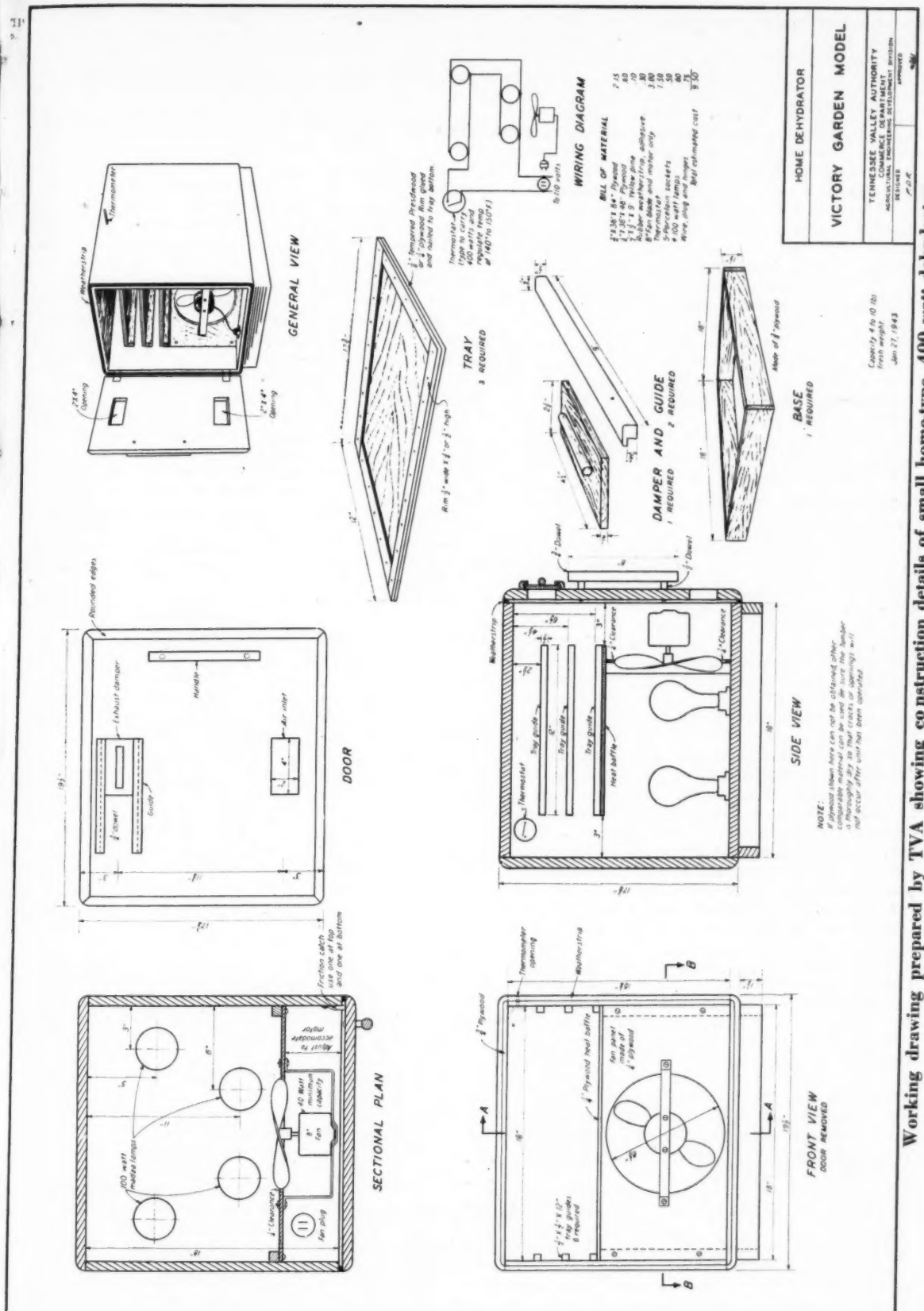
"When you have wire of unknown resistance, the only solution is either to determine the resistance by instruments or to find the proper wire length by the trial-and-error method.

"A coil can be made from the wire by placing a one-eighth inch rod or wire in a breast drill to provide a mandrel or core which



Type	Capacity Lbs. Fresh Apples	Tray Area	KWH/Lb. Apples 12%	Total Watts	Watts/Sq.Ft. Tray Area	Fan Size	Recirculating	Hrs. To Dry Apples 12%
1	16	10.4	3.9	1200	96	10"	Yes	10
2	16	10.6	4.0	1200	112	8"	Yes	12
3	17	11.6	4.2	900	78	12"	No	16½
4	39	25.8	4.2	2000	78	12"	Yes	13
5	32	21.2	3.8	1500	70	10"	Yes	17

The Arkansas Power & Light Co. has distributed much helpful information on dehydrators. These programs show various arrangements of shelves and heating units. The table gives basic operating data.



Working drawing prepared by TVA showing construction details of small home-type, 400 watt dehydrator.

can be turned rapidly to wind the wire on it.

"It might be worth while to add that any form of electric heater in an enclosure such as the dehydrator cabinet is 100% efficient. There can be no difference in the amount of energy consumed between any two types unless special conditions exist. An example would be found when a high-temperature element was mounted close to the wall or floor of the cabinet. Under such circumstances, the wall or floor would become very hot and the heat loss at that point would be higher than at all other points which remain at about 150 degrees. All the light from a lamp is converted into heat when it strikes and is absorbed by the walls, trays, etc. It is quite feasible to use such things as electric hot plates, irons, or iron elements for heating units.

Thermostat Use Recommended

"Electric lamps can be controlled by merely unscrewing one or more to reduce the cabinet temperature. However, it is probably better in many cases to use a thermostat to control the temperature. Any type will do which will handle the load and has a working range that includes 150 degrees and a differential of not more than 10 degrees, but preferably only 5 degrees."

Several suitable locations were found for a thermostat. Two general restricted areas where they should not be placed are in the intake air stream and in direct line with radiant heat from the heating element. In connection with proper control, a good thermometer should be provided. It can be laid on one of the trays, hung inside and viewed through a glass window, or placed in a hole drilled through the inside of the box.

Fans present some problems. It would be better to design a cabinet for a particular fan and use that type in all units. Since there is some interest in using fans on hand, and also the fact that fans are becoming more difficult to get, a few pointers are given by Mr. Rodgers: "First of all, very cheap fans should be avoided. These fans, although they may look big and husky, just do not have enough capacity. Any of the narrow-blade, high-speed office or home fans of well-known makes seem to be suitable. Also there are those which are mounted in a rectangular plate to be used in a kitchen window and other through-the-wall applications. These are good and are much easier to mount in the cabinet than the pedestal type. So far, we have not found any damage to any of the fans as a result of using them in the 150-degree atmosphere.

"In any case, a carefully made diaphragm or orifice plate should be provided unless the fan is already mounted in one. This consists of a sheet such as ¼-inch plywood having a hole slightly larger than the fan cut in it and made to fit the space around the fan so as to cause all the air to pass through the hole. In other words, a wall is built to divide the lower part of the dehydrator and a hole is cut into it to receive the fan. The fan blade hub should be placed up to or slightly through the diaphragm. Carelessness in making the diaphragm and placing the fan will result in loss of fan capacity. Of course provision should be made for getting at the fan for oiling or servicing. If this point is neglected, the fan will probably be operated without attention until it breaks down."

In research, various dehydrators were tried out. They were built and rebuilt to get best results.

The number of watts of installed heating capacity per square foot or tray surface varied considerably. A low figure of 70 per square foot was found to be too low. It will not bring the temperature up fast enough at the start. This could be overcome by adding more heat or by preheating the dehydrator before the material is put into it. The high capacity of 112 watts per square foot was found to be good in that it provides a quick heat-up, and the shorter this period can be made the sooner the material can be dried.

From observation of the tests, it was found that the best amount of wattage, considering the heat-up time, cost of heating elements, load on the house circuit, and cost of controls, should be about 70 to 90 watts. Of course, the design and the amount of insulation on the box could change the figures.

Fan capacity is important. The higher the velocity of the air over the material, the faster it will dry. Apparently a velocity of about 300 feet a minute should be arrived at.

TVA No. 2 Model dehydrator "did a fine job of dehydration," Mr. Rodgers reported. There was no tendency towards scorching or toasting. The lower trays dried slightly faster than the upper ones. Corrections could be made by means of deflectors in the air stream which would make all trays dry evenly, but the added complexity and cost would not be worth the gain from practical standpoint. The cabinet was made to fit into the kitchen. It is 36 inches high and 24 inches deep, the same as standard kitchen work space.

TVA No. 1 Model is designed for back porch or outbuilding operation. It can be built as large as desired. Of particular interest is the simplified design and the booster heater. A coil of 500 watts capacity is used between the two banks of trays to pick up the air temperature after it has dropped during passage through the first bank of trays.

Kitchen Models Under $10

Two small home electric dehydrators were tentatively termed "kitchen" and "Victory" models by the research men. A primary consideration in the development of these units has been to hold the cost of the dehydrator to a point within the means of the average family. Materials for constructing the "kitchen" model cost approximately $10, less the fan which can be a standard 10 or 12 inch household fan. Materials for the "Victory" model cost about $10, which includes an allowance of $3 for a small 8-inch fan.

Technicians also developed two other models: a porch unit with a capacity of about a bushel for large farm families, and a large community dehydrator (capacity about 50 bushels) which is undergoing extensive testing at four rural communities in Georgia and at the University of Tennessee. All models are constructed largely of non-essential materials and researchers said that anyone could make them.

The kitchen model dehydrator has attracted the most attention nationally. Five 200-watt light bulbs provide the heat, and a small fan circulates the air.

Dehydration is admittedly a wartime measure for preserving foods and researchers say its stability after the war depends upon the quality of the products produced. The rate of production of dehydrated foods is increasing

(Continued on page 59)

Marine Electrical Work New Field for Contractors

By Geo. H. Watson

SHIPBUILDING has opened up a giant new industry in the South. One of the first electrical contractors to enter that field and be accorded a separate contract for the elecrical work was the Knight Electric Company, of Birmingham, Alabama.

This concern pioneered in this field by doing the electrical work on several small vessels built by the Ingalls Shipbuilding Company, between 1935 and 1939, at Decatur and Mobile, Ala. Then the Ingalls company was awarded bigger contracts and decided to erect a new shipbuilding plant at Pascagoula, Miss., on the site used for a small operation of this kind during World War I.

The Knight company then organized a separate and distinct corporation, known as Electric Constructors, Inc., to handle the Mississippi operations. D. B. Clayton is president and C. L. Teal is secretary-treasurer. Mr. Clayton lives at Pascagoula as executive in charge of the work.

The company started out with 25 to 30 men and as new ship contracts came in, and the extent of the work grew, kept adding men until now about 1,000 are employed. In addition there are two sub-contractors under the electrical contractor, one of whom furnishes the labor on vessels under construction and one furnishes the labor required in wiring.

Many of the electricians working on the Pascagoula job are landlubbers who up until a few months ago never set foot on a ship. Now they are helping build vessels which sail the seven seas. Quite a few of the workers are women—something new in the electrical field. Besides women in the office, girls are also doing such jobs as running drill presses, pipe threaders, and strap bending machines, as well as checking cables and working in the electrical warehouse.

The company took its own key men on the job and then expanded the organiztaion as necessary to take care of the work. The first nine months were spent largely in providing power and light for various ground buildings and facilities including the mold loft building, the fabricating shop, and the ways.

Pascagoula operations started off with four large size cargo vessels built for the U. S. Maritime Commission. After these, large passenger cargo vessels with all modern conveniences, including swimming pools, were built and these turned over to the government. These have been followed up by many more cargo ships.

The accompanying chart shows something of the organization set up to handle the electrical work at the Pascagoula operations. Under the executive in charge come the departments devoted to timekeeping, to general stores and purchasing, to estimates and materials, to planning and to general superintendence. Under the general superintendent is a marine construction superintendent and a facilities supervisor (the latter for ground operations).

For each vessel under construction, there is a ship supervisor who has under him a foreman for layout, for welding and erection, for cable pulling, for power, for lighting and for radio and inter-communication. Under each foreman are enough leadermen and crew to do the job. Each leaderman has an average crew of 12 to 15 men.

While in actual practice several different operations may be carried on at once, the usual procedure with the electrical work is as follows: The layout crew, with chalk or marking paint, shows location of all cable, outlets, switches, etc. Next come the welding and erection crew who erect cable hangers and other equipment which has to be securely attached by welding to the body of the ship. Then the cable crew pulls in the cable. Next the lighting crew installs lighting fixtures and wiring devices. The power hook-up crew then connect all motors, switchboards and other apparatus. Finally, the radio and I-C (inter-communication) gang complete its work.

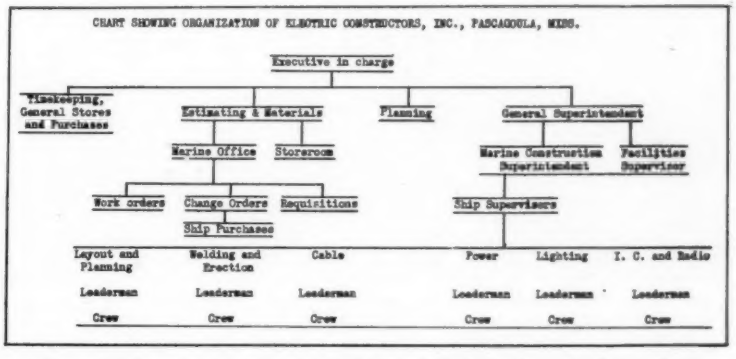
Most electrical equipment used on the job, including cables, fixtures, fittings, are of watertight construction. The cables, of basket-weave construction, are supported either by strapping to the bulkheads or supporting them by overhead cable racks. Some of these carry as many as 40 to 50 cables. Cables are mostly concealed in finished rooms with main runs being in wells or passageways. In engine rooms and holds, the cables are left exposed but out of the way of other piping, insulation, etc. Fixtures are of modern marine design.

Cables used on the job varied in size from No. 14 to 1,250,000 cir. mil. I-C cables varied in size from No. 16, 2-conductor, up to as high as No. 16, 40 conductor.

The ships are powered by oil burning engines. Forced draft fans provide ventilation through ducts to passenger and crew spaces. Kitchens are all-electrical with modern refrigeration for food storage.

In discussing the job, Mr. Teal said that a school for electricians

(*Continued on page 58*)



How workers were organized for marine electrical work.

Educational and Service Booths Help Meet Customer Needs

DALLAS Power & Light Company, of Dallas, Texas, has completed the process of changing its sales and display floor from a merchandise salesroom where small appliances and portable lighting equipment were sold to a "home service center," in which there are booths demonstrating the various phases of the use of electricity in the home.

Though they now have nothing but current to sell—excepting lamp bulbs, of course—they do not want to lose the benefit of the vast amount of work done in the past in teaching the public about time- and labor-saving uses of electricity. They feel that the services of DP&L should be kept in the public mind during the war.

Some of the appliances or other items shown on the floor are not obtainable at the present time, but by having booths and demonstrations, it is hoped to keep alive the desire of the people to obtain all the things electricity makes possible after the war is won.

Prominently located is the "Information Center," located right in the middle of the lobby where the customer entering will see it first. The purpose of this booth is not only to give information concerning lobby exhibits but for answering all inquiries. These inquiries cover every phase of the company's electrical service, such as "Where do I pay my bill," "Whom do I see about getting electric lights," and occasional questions that have no connection with the company or its service.

Prominent Information Center

The Information Center eliminates confusion on the part of the stranger or new customer who comes in and doesn't know whom to see or where to go. Someone is kept in or near the booth at all times that the building is open. Usually a girl is on duty, though sometimes it is a man, the floor supervisor.

The company has coordinated all of its general public and some dealer relationships into a single "home service" operation, under one head, Herbert M. Walne, home service director. This includes the auditorium on the second floor and the auditorium economist as well as all booths and other "enterprises" on the lobby floor.

"Everything we now are doing is 'home service', " Mr. Walne said. "Since this department has been broadened out it has absorbed the dealer co-ordinating department and the merchandising department. And it also includes the repair service as a part of the home service. We figure that repair service now is a very important factor in the whole picture."

Home service now includes field service calls when they are requested though there are not so many as formerly; that is, service calls on a range, an ironer, a washer or on a lighting problem. All of the normal free services offered in the field are being maintained.

Contacts still are maintained with dealers, there being one coordinator out in the field calling on some forty electrical dealers.

The company has a splendidly

equipped auditorium on the second floor which is available for cooking and home economics schools and for the use of clubs, church groups and others. Some very successful cooking schools have been held. Wartime cooking schools and canning classes are quite beneficial and are proving popular.

A home economist is kept available in the hostess office of the auditorium all the time. She answers inquiries on canning, cooking, etc., many of which are received, sometimes as many as thirty to fifty in a day. She is also available to help the public in planning parties and in many ways in assisting in the use of the auditorium.

Cooking Booth Popular

Among the booths in the lobby the one on "Wartime Cooking" probably is most popular at the moment. Seasonable demonstrations are carried on in it by economist on duty. These include cooking, canning, preserving and dehydrating (the newest feature added). Equipment includes all of that customarily found in the modern all-electric kitchen, with the addition of a pressure cooker and can sealer. One difficulty now is that, in spite of signs stating that the equipment is not for sale, visitors are continually trying to buy some of the appliances there, particularly the cooker and the sealer. Booklets on canning and other processes are handed out to visitors.

At the "Use and Care" booth the visitor learns how to make her appliances last for the duration and how to get the most service from them. Here again are seasonable demonstrations. In late spring, for example, there was a miniature house, showing complete operation of an attic fan, calling attention to the need at this time of having the fan cleaned and oiled and the system made ready for summer use. And on a table was an electric iron, disassembled to show the effect of arcing at the electrodes when the cord is disconnected at the iron before the other end is removed from the outlet.

Another panel in this booth tells two stories—how to change fuses and how to understand and read the electric service meter. These stories are made clear to the householder with just a bit of explaining by the girl on duty. According to Mr. Walne, this booth has been quite effective in helping keep high bills

(*Continued on page 58*)

Shown here are the three most popular booths of the Dallas Power & Light display floor: use and service booth on appliance care and fuse changing, wartime cooking booth, and a comprehensive lighting display.

What About Postwar Models?

Appliance manufacturers appear to agree on the point that there will be no radical changes in post-war models until new developments receive adequate factory and field tests.

A POST-WAR policy "with both feet on the ground" is outlined by T. J. Newcomb, sales manager of the Westinghouse Electric Appliance Division, Mansfield, Ohio, in an open letter to 32,000 electrical dealers throughout the nation.

"Our post-war planning in the interests of consumers and dealers covers two stages," Mr. Newcomb reported. "First, when the war is over we plan to get into production fast on essentially those products you sold just before the war. We shall improve them but won't experiment with radical changes."

The second phase, the Westinghouse executive explained, is to "bring along the revolutionary new developments as quickly as they can be proved."

Mr. Newcomb's letter opened with the question: "when peace comes and the post-war planning you're hearing so much about can be expressed in actual products—what will you, as an electrical merchant, be most interested in?

"We believe you will want a line of products which you can get for actual selling — fast," the letter continued. "It's all right to talk about new plastic refrigerators and glass ranges, but if you have to wait for months before you can get such products, you're not going to play many tunes on your cash register meanwhile.

"Second, you will want products that have acceptance. Neither you nor your customers will want to experiment with new and untried products and materials, no matter how novel and glamorous.

"So we think post-war planning in your interest means our getting into production fast, getting you a line of products you know will give customer satisfaction—products that give you low selling cost, low service cost and quick turnover and profits."

Mr. Newcomb emphasized that Westinghouse has its share of new and revolutionary designs for ranges, refrigerators and other appliances, "and we're as far advanced with them as any patriotic manufacturer could be who is 100 per cent in the war effort.

"But," he pointed out, "we have been in this business a long time, and we know that nobody can introduce new and revolutionary things without 'bugs'. And 'bugs' mean delays in getting onto the market, service expense to dealers, disappointment to customers."

Dealers and customers will hear a great deal about appliances that are coming after the war, the Westinghouse sales manager predicted, continuing: "You're going to be told to wait for them. You're going to be told that everything you sold in the past will be obsolete in comparison with what is coming. And that's so—eventually.

"All we say is that products that are coming ring no cash registers until they arrive. Rushing into them may mean expense to you. We all know that the products you sold in the past gave mighty good customer satisfaction and performance. And with the huge post-war demand, what is more sensible than to give the public good, proven products—quickly?

"There may be some radical new products in the immediate post-war period as a result of new manufacturers who have no time-tried pre-war designs, the letter declared, "but we and certain other manufacturers like us have an experience that involves a lot of 'know-how' in appliance engineering, manufacturing, and in working with and making money for dealers."

●

IF THE WAR tapers off with the collapse of Germany and a longer fight with Japan, American industry will be prepared for quick conversion to peace-time production and for making impressive changes in new models of household appliances, Howard E. Blood, president of the Norge Division of Borg-Warner Corporation, announced recently following an extensive tour of eastern and mid-western cities.

"Our war production is ahead of contract schedules," Mr. Blood said. "That's why our engineers are giving more thought to new products for home use and peace-time production. There will be very aggressive competition in the post-war period and many important companies are preparing for it. The signal for tooling and speedy conversion will be definite indications of a smashing victory for the Allied cause."

Mr. Blood warned, however, against taking too literally the enthusiastic forecasts of immediate radical changes in the design of American products during the period following the war, particularly if the war ends quickly.

"There will be improvements, of course, but it may be impossible to make tools for some of these during the war," he added. "Many manufacturers will resume just about where they left off."

Mr. Blood addressed several of a series of meetings of Norge distributors and dealers which were held in more than 50 cities from coast to coast. He told the dealers that the company is launching a comprehensive advertising campaign which will seek to build up consumer expectation and an eager market, after the war, for Norge refrigerators, ranges, washers and other household equipment.

Reviewing the company's war production accomplishments in its Detroit and Muskegon plants, Mr. Blood said that Norge engineers had re-designed several war products, cutting down weight and reducing costs, besides curtailing the use of critical materials. The company won special recognition for its success in re-designing and producing naval powered gun turrets.

"Techniques and precision methods learned in war will perform wonders in the products of peace," Mr. Blood declared.

Norge also has been making aircraft gun turrets, airplane engine parts, gear sets for airplane propellers, vacuum pumps, valves, parts for tank fire controls and transmissions for landing boats.

●

By R. C. Cosgrove*

DEALERS must not expect refrigerator manufacturers to be turning out "dream models" of the ultra-modern refrigerators you may have seen pictured, as soon as the war is over. Eventually, we will be having domestic refrigerators and peace-time appliances such as had not been thought of before the war, but not immediately.

Some people feel that we may be making some civilian refrigerators within a year from now. The government has under consideration making available some materials for development purposes on peace-time refrigerators and other household appliances next fall.

Within six months after we get permission to go ahead, we can be making domestic refrigerators. This doesn't mean the creations in plastics that have been pictured but the 1942 refrigerators with some few improvements.

It will take an extensive period of testing before we would feel safe in going ahead on plastic refrigerators, as it would be very expensive to a company to produce a line of refrigerators that would fail in service.

Within four to five months after we have been told that we may make home radio sets, we can be making them—the same kind of radio receivers we were making when civilian production stopped, with some improvements.

We are planning at Crosley, as all industry is planning, to keep employed, after the war, the many additional thousands of persons we have added to our payrolls to help get out the immense volume of war products.

We are going to have tremendous manufacturing capacity after the war and none of us want to go backward. We want to keep all of our people busy.

Most of us believe that Germany will be knocked out of the war first, and that Japan will be defeated some time later. If the attrition idea of carrying on the war prevails, we may get into the gradual production of home radios and other peace-time products earlier than otherwise. We could then make the transition from war to peace-time products without much trouble.

The radio industry's volume before the war was $325,000,000 while, last year, it turned out a total volume of war radios amounting to $1,200,000,000.

Just after the war ends, there will be a huge pent-up demand for goods and there will be war savings with which to buy them. After that, sales will not come so easily and they will require a lot of hard digging.

The principle of free enterprise, as contrasted with the dictator-ruled

(*Continued on page 56*)

*Mr. Cosgrove is vice-president and general manager of the manufacturing division of the Crosley Corporation, Cincinnati, Ohio.

Servicing the Refrigerator

Part 4: Servicing High Side Floats*

THIS TYPE of liquid control device is commonly called "high side float" because the float ball is located in a chamber subjected to the high pressure or condensing pressure of the system. This article covers the operating characteristics and service diagnosis of typical refrigeration systems using the high side float for controlling the flow of high pressure liquid to the evaporator.

The function of the high side float is to regulate the flow of liquid refrigerant from the condenser, or high side, into the evaporator, or low side, of the system, thus maintaining a constant level of refrigerant liquid in the float chamber.

By reference to a simple cycle as illustrated in Figure 1, we find practically all the liquid refrigerant stored in the evaporator or low side. The only liquid stored in the high side is that in the float chamber at sufficient level to permit the needle to close on the seat.

In a typical high side float control, a float ball, located in the chamber, is attached to the needle valve by means of suitable linkage and fulcrums. The needle valve is actuated toward the seat, or the closed position of the valve, by any downward movement of the ball. Conversely, the needle moves away from the seat, or into the open position, by any upward movement of the ball.

The common construction of high side floats is vertical. This feature assures that the needle valve and seat will be completely covered with liquid when the ball is at the lowest point of travel and the valve closed. This liquid seal at the valve seat eliminates the erosion of the valve needle and seat by vapor. It prolongs the life of the valve and eliminates numerous repairs or float changes.

Float Operation Explained

Any movement of the float ball and needle must be accomplished by a change in the liquid level in the float chamber. As the compressor pumps refrigerant vapor into the condenser, the vapor condenses into a liquid and then the liquid flows into the float chamber.

When the liquid enters the float chamber and raises the level slightly, the float ball raises with the rise in liquid level and opens the needle valve sufficiently to establish a rate of flow from the chamber into the vaporizing coil

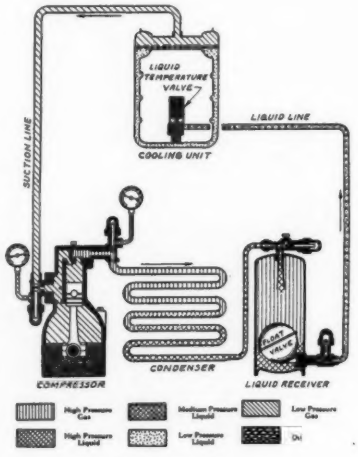


Figure 1

equal to the rate of flow from the condenser. The movement of the float therefore is dependent upon any change in the capacity of the compressor which results in a change in the rate of liquid flow from the condenser into the float chamber.

The capacity of the compressor for a given room or condensing temperature is largely dependent upon the suction pressure in the vaporizing coil or cooling unit. For a fixed amount of surface in the vaporizing coil or cooling unit and a fixed temperature surrounding this surface when the compressor is running, the suction pressure is dependent upon the amount of the surface in the vaporizing coil or cooling unit that is wet with liquid refrigerant.

In a high side float system, the amount of surface wet with liquid refrigerant is entirely dependent upon refrigerant charge. Therefore the maximum travel of the float is at the beginning of the cycle, and then only when the vaporizing coil is fully charged with refrigerant with its resulting maximum suction pressure for a given cabinet temperature. The refrigerant charge, therefore, is the predominating factor in obtaining normal movement and operation of the high side float.

High side float liquid is used on household refrigerators, ice cream cabinets, beverage coolers, water coolers, and room-cooler self-contained unit systems. Analysis of the refrigerant cycle indicates that the high side float application should be used only on a single evaporator or a series of evaporators in a single compartment connected to its individual condensing unit. Multiple evaporators or parallel evaporators cannot be fed successfully with high side float control.

On some large commercial installations, one float can be used to feed two or more continuous pass evaporators in series. The service difficulties encountered as

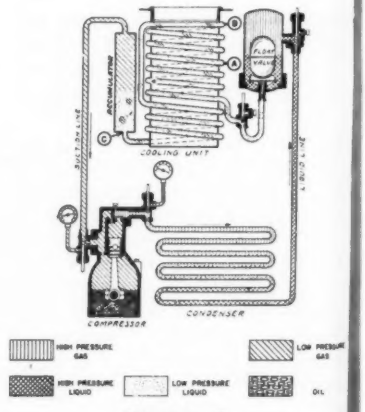


Figure 2

*This article is published through the courtesy of the Nash-Kelvinator Corp. It relates to service on refrigerators of all manufacturers and not to Nash-Kelvinator products alone.

a result of sudden load changes on evaporators in series, offsets any advantages obtained unless all evaporators are in a single compartment where they experience the same load changes.

Referring to the refrigerant cycles, Figures 2 to 8 the volume of refrigerant required to flood or wet all the surface of the evaporator must be greater than the volume of the condenser tubing. The combined volume of the space above the liquid in the float chamber and the condenser tubes can be greater than the evaporator. This usually is the case in the majority of household refrigerator systems so that the high side will hold the entire refrigerant charge.

If the evaporator volume is smaller than the condenser tube volume alone, at light loads and with cool condenser air passing over the condenser, the condenser tubes may hold all of the refrigerant liquid. Should this happen, no liquid could drain into the float chamber to float the ball and effect a return to the evaporator. On the other hand, if the evaporator volume is greater than the condenser tube, as the condenser tube fills with liquid, there will be sufficient liquid left in the evaporator so that the compressor will heat the condenser and force the liquid to drain into the float chamber.

On systems with a correctly balanced evaporator volume and condenser tube volume, an adequate refrigerant charge can permit all the refrigerant liquid to stay in the condensing tubes, thus giving the symptoms of a float stuck shut or a frozen feed line. The necessity of the correct refrigerant charge on high side float systems cannot be emphasized too strongly.

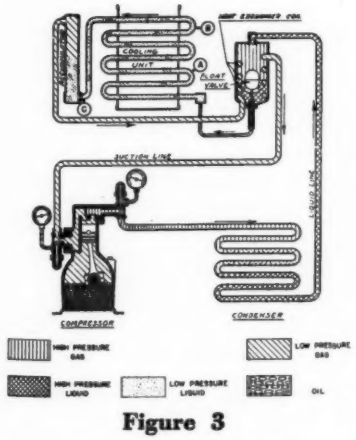


Figure 3

Float with Heat Exchangers

Tests prove that the use of heat exchangers on systems using Freon-12 are essential for efficient operation of the system. On a simple high side float system, the refrigerant liquid passing through the float valve immediately changes pressure and temperature equal to that of the evaporator, and the feed line from the float to the evaporator becomes, in effect, a part of the low side. This characteristic of a simple system prevents the exchange of heat between the warm liquid and the cooler suction gas. To obtain the benefit of sub-cooling the liquid by this exchange of heat, two methods are used on some high side float systems and

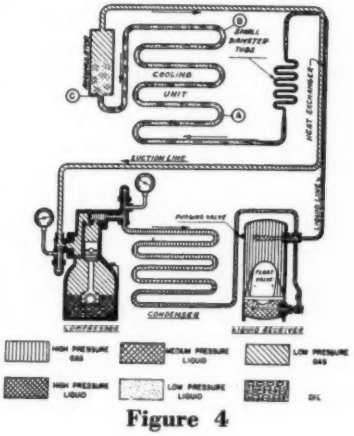


Figure 4

are illustrated in Figures 3, 4, and 7.

The construction of the system illustrated in Figure 4, permits the exchange of heat from the liquid line to the suction line by soldering the suction and liquid line together and placing a small diameter tube in the liquid line at the evaporator inlet. This small tube throttles the liquid flow from the float to the evaporator, thereby keeping the pressure and temperature in the liquid line much higher than the suction gas temperature. The heat will then flow from the warmer liquid to the cooler suction gas.

This type construction is advisable on brine or any type system where the pull-down is very long. By proper design, the suction pressure can be limited on the pull down to prevent continued overload on the motor. It is used on certain water coolers and beverage coolers.

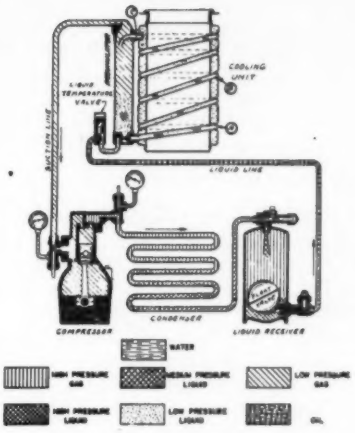


Figure 5

With the system illustrated in Figure 3, the heat exchanger is built into the bottom of the float chamber where it is submerged in the liquid surrounding the float ball. The exchange of heat is from the warm liquid in the bottom of the float chamber to the cool suction gas passing through the coil. On this type of system, the connecting tube between the float outlet and the evaporator is a part of the low side and must be insulated for a temperature below 32 degrees F. The insulation on the tube must be sealed thoroughly to prevent ice from destroying the insulation. This type of system is especially suited for self-contained units where the outlet of the float is reasonably close to the evaporator inlet. It is used on certain types of ice cream cabinets and household refrigerators.

On certain sulphur dioxide systems only, a heat exchanger effect is accomplished as illustrated in Figure 7. The superheated vapor leaving the compressor enters directly into a receiver where most of the superheat is removed from the vapor. The near-saturated vapor enters the condenser tubes where condensation occurs. The liquid leaving the condenser tubes passes through the liquid line to a small volume float chamber. The liquid line is soldered to the suction line to subcool the liquid before it enters the small volume float chamber. The receiver location ahead of the con-

denser functions to remove the superheat from the vapor, acts as a receiver to hold the complete charge should stoppage occur from the float, and permits pressure flow of the liquid to the float chamber.

Float with Liquid Temperature Valve

On some earlier household refrigerators and on beverage coolers, a simple high side float system furnished the liquid control. To eliminate the frosting or the necessity of heavy insulation on the connecting tube between the float and evaporator, a liquid temperature valve was installed in the liquid line directly at the evaporator inlet. See Figures 5 and 6.

The purpose of the valve is to maintain pressure on the liquid line. The weight of the valve is such that a pressure difference of 25 lb. gauge is maintained between the liquid line and the evaporator. This pressure is sufficient to keep the refrigerant in the liquid state during its passage from the float valve, through the liquid line to the liquid temperature valve. The liquid line, consequently, has a high enough temperature to be above the dew point of the surrounding air. This prevents objectionable condensation and frost from forming on the liquid line. A small diameter liquid line of predetermined length will accomplish the same result.

Service Diagnosis

A study of the construction of floats illustrated under Figures 2 to 8 indicates that the possibility of mechanical trouble wtih the float is very remote. Most failures are traceable to other characteristics that directly affect the operation of the float. There are only three characteristics that result in actual failure of the float.

(1) Friction of the actuating levers and pins resulting from foreign substances or corrosion, caused by moisture in the system. Agitation of any foreign substance in the chamber may cause the valve orifice to plug.

(2) The valve seat may leak as a result of erosion or cutting by foreign substances lodging between the needle and valve seat.

(3) The float ball may fill with liquid or collapse (thus losing its buoyancy) and valve not open when additional liquid enters the chamber. In most cases, this condition is brought about by extremely high pressure in the condenser and float chamber. This excessive pressure can be traceable to non-condensable gases in the condenser tubing, oil slugging, or in combination with stoppage of refrigerant flow from the chamber.

There are several other characteristics that may indicate float failure where, if the proper analyses are made and remedies applied, the float would function normally. It is important to recognize the following symptoms which may be confused with float trouble. Proper diagnosis will eliminate the unnecessary procedure of changing the float assembly only to find the difficulty remaining.

(1) **Insufficient Refrigerant Charge.** If the refrigerant charge is under the minimum quantity to wet all the evaporator surface, rapid change in condensing temperature may cause sufficient refrigerant liquid to stay in the condenser and not drain into the float chamber. Should this occur, the compressor will pump out the low side and the symptoms will be similar to a stuck shut float, collapsed or sunk float ball, clogged orifice, or frozen feed line resulting from moisture in the refrigerant. When a system is short charged to a critical point, the compressor may reduce the suction pressure so rapidly at the beginning of the cycle that oil will slug over into the float.

A compressor will slug oil only by a rapid reduction of pressure in the crankcase. This can happen only by deliberately closing the suction service valve or by a low charge of refrigerant in the system. When the system is short of refrigerant, the oil level in the crankcase will be low.

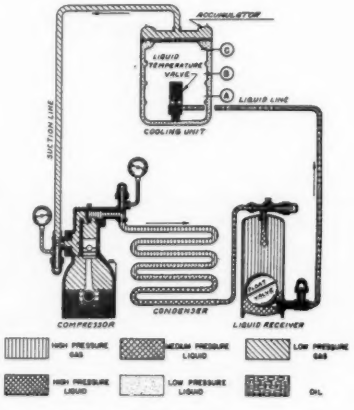


Figure 6

(2) **Slight Overcharge of Refrigerant.** This condition permits compressor crankcase to operate at lower than normal temperatures. If the oil in the crankcase is comparatively cool, a greater percentage of refrigerant will go into solution with the oil on the off cycle. When the compressor starts at the beginning of the cycle, the suction pressure reduction is faster than it is later on in the cycle. If the oil becomes nearly saturated at the cut-in-pressure, any reduction lowers the quantity of refrigerant that can stay in the oil. The compressor slugs oil over into the condenser adding to the volume of liquid in the high side. Since the only liquid that can stay in the high side is sufficient to float the ball, the ball raises further and floods more refrigerant into the crankcase. This symptom occurs also when a float is stuck open.

It should be membered that when the charge is correct, a leaky or stuck open float wll not flood the crankcase. The accumulator acts as a reservoir for the slight amount of liquid between the normal level in the float and the level to which it may lower to uncover the valve orifice. Actual tests with floats leaking badly enough to balance the high and low pressure in five minutes after the unit stopped did not pull liquid over into the crankcase.

(3) **Water Cooling Troubles.** Failure of the water regulating valve on water cooled systems to maintain fairly constant outlet temperatures, or surging of the water valve, may cool off the condenser sufficiently fast to reduce the pressure difference between the condenser and the float chamber so that all the liquid will stay in the condenser. This symptom is similar to that of erratic float action or a stuck shut float.

(4) **Air in System.** Air or other non-condensable gases in the system will ultimately collect in the top of the float chamber. This condition will result in a higher than normal pressure in the condenser to force the liquid into the float. The condenser will have to partially fill with liquid to raise the pressure. The low side will be starved by the amount that stays in the condenser. On air

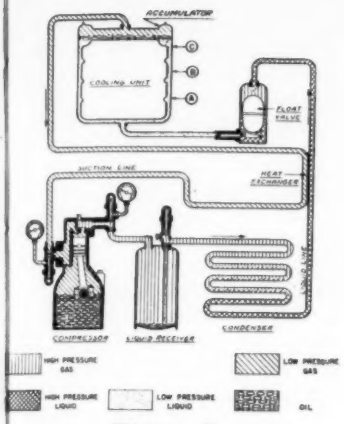


Figure 7

ooled systems short of refriger-nt, the condenser may hold all f the charge, and on water cooled oats, the system may pump down ith a full charge of refrigerant.

Before attempting to analyze e trouble on any high side float stem, be sure that the refriger-nt charge is normal and that all n-condensable gasses are re-oved from the condenser and oat chamber.

Proper Refrigerant Charge

For successful operation, all e surface in the evaporator ust be wet with liquid with some quid spilled over into the ac-mulator or up into the header. he charge specified by the manu-cturer for unit systems will tisfy this condition. When a stem is empty of refrigerant, e most practical way to obtain e correct charge is to completely acuate the system and weigh the factory charge. There is me chance of an error in weigh-g in refrigerant on a service ll because of the physical limi-tions of the equipment available. hen this method is used, there-re, make certain that the con-cting tube to the cylinder does t interfere with accurate weight d that no appreciable weight of frigerant is lost when discon-cting the connecting tube.

To check the charge in an oper-ing system other than room olers, the following conditions st prevail: (1) The suction essure must be below the cut-in essure-temperature for the par-ular system. For example, a eon-12 ice cream cabinet, 20 .; an SO-2 household refrig-tor, 6 lbs. (2) The head load on the evaporator must be near normal or such that will keep the unit operating a sufficient length of time to check the charge. For example, the evaporator coil on a wet type beverage cooler must be covered with water. A slight flow of water must pass through a water cooler, a tray of water starts to freeze in a household refrigerator evaporator. (3) The refrigerant must be added if possible during one on-cycle of operation.

By referring to the refrigerant cycles (Figures 2 to 8) the letters A, B, and C appear on all evaporators. Assume that an SO-2 household cabinet, illustrated in Figure 7, has a short charge so that the evaporator is wet with liquid to the point "A"; the compressor operating with a suction pressure of 6 lbs. If an SO-2 cylinder is attached to the suction connecting line and the cylinder service valve is opened to admit vapor, thereby adding refrigerant to low side, the amount of surface wet with liquid will be increased so that the liquid will reach point "B". This will raise the suction pressure above the 6 lbs. first observed. If vapor is added from the cylinder intermittently, the suction pressure will rise at each operation until the liquid reaches point "C". The reason for the pressure rise is that more surface is wet with liquid and more refrigerant is vaporized. When the liquid reaches point "C", any additional refrigerant added will spill over into the accumulator.

At this point, there is a minimum charge in the system. The manufacturer's charge contemplates filling the accumulator of header at least one-third full of liquid. When "C" is reached, add a slight additional quantity of refrigerant. Continue to add refrigerant and the accumulator will be filled and begin to spill liquid over into the suction line. At this point the system is overcharged.

On systems with a heat exchange coil in the float chamber, as illustrated in Figure 3, any liquid pulled out of the accumlator into this coil will immediately reduce the head pressure from 5 to 15 lbs., depending upon how much liquid enters the coil. The suction gauge will also drift over a 2 to 4 lb. range as the liquid flashes off to vapor in the heat exchanger coil. If this condition exists, purge slightly until the head pressure rises back to normal and the suction gauge is stable. On the other type systems, a slight overcharge will pull over into the suction line, and if a suction line to liquid line heat exchanger is used, the liquid will be subcooled by evaporation, and nothing will be gained from the heat exchanger.

When a system has been operating with a short charge, the oil level will be low in the compressor; the oil will be trapped in the evaporator. By adding refrigerant until a spill over into the accumulator occurs, the oil will start to return to the compressor. When the oil level is low in the compressor, add refrigerant as described and the oil will return to the crankcase. When point "C" is reached by following the above procedure, permit the unit to operate 10 to 15 minutes for Freon-12, 15 to 20 minutes for methyl chloride, and 20 to 30 minutes for SO-2 systems. This gives time for the oil to return to the crankcase. Then make a final observation as to suction line temperature, head pressure, and suction pressure.

How to Add Refrigerant

When adding refrigerant to a high side float system, never try to force the refrigerant from the cylinder into the high side. Always admit vapor through the suction service valve. The cylinder should be sufficiently warm to result in a pressure in the cylinder of at least 20 lbs. above the pressure in the low side so that when the cylinder valve is opened, the

(Continued on page 56)

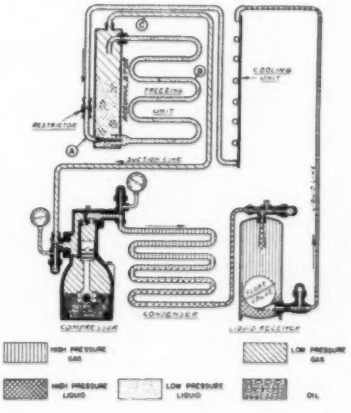


Figure 8

Improving Production Efficiency In Motor Rewinding Shops

By L. H. Houck

THIS is the last of a series of three articles describing the time-saving practices of the Tampa Armature Works of Tampa, Florida. The two preceding articles appeared in April and May 1943 issues of this publication.

BEFORE the war if a motor winding shop had been told to reduce its inventory 50 per cent in the face of a 150 per cent increase in business volume almost no one would have hesitated to say, "It can't be done!"

Today, in the middle of the biggest war in history, when almost any citizen will tell you that none of the Washington bureaus know what they are doing, and that the one which has upset business traditions most is the War Production Board, it is refreshing to hear a good word for the War Production Board and see some tangible and valuable results of its planning which will be carried over in after-the-war business.

"The War Production Board taught us how to do more business on less material," reports J. Arthur Turner, president of the Tampa Armature Works, "and today we know more about our business than we ever did in normal times."

To obtain critical materials under war conditions, it was necessary to have an accurate inventory of stock on hand, Mr. Turner said. It was also necessary to anticipate requirements.

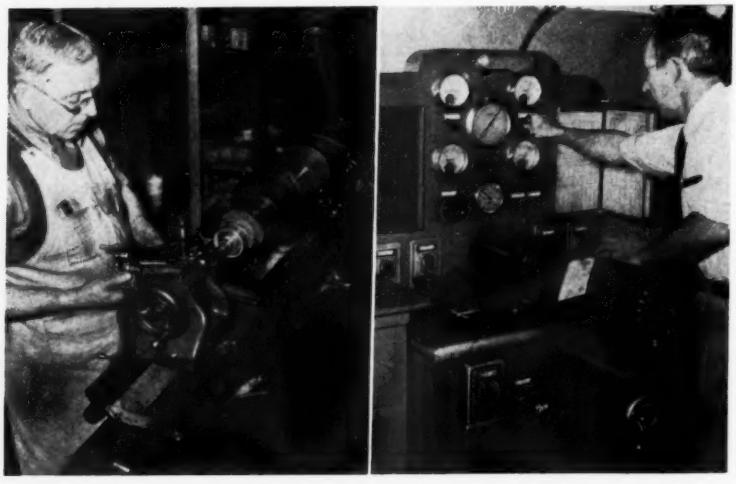
The normal stock of magnet wire at the Tampa Armature Works was about 24,000 pounds, which included all sizes of rounds, squares and rectangulars. The effect of war conditions was to increase the volume to 150 per cent above normal.

Under normal conditions, this would have required a corresponding increase in wire stocks but the WPB came in with their allotment plan and ordered a reduction of 50 per cent, which reduced the inventory to about 12,000 pounds.

Advantages of the reduction was that at least $4,000 was released in cash which could be applied to increased payrolls and other expenses. The real problem then was how to do three times the business on 50 per cent of the copper.

Reduction in inventory was accomplished by reducing sizes and shapes carried. In work going through the shop, motors were wound for the load they carried rather than for exact replacement of burned out windings.

For instance, a motor known to always carry a light load or only



An important factor in the operating efficiency of Tampa Armature Works is the use of modern tools and equipment to as great an extent as possible. At left are shown two such items, a small lathe having many uses in a motor shop and a motor test board. On the next page are some of the special time-saving devices utilized by this firm. Below, the Jacksonville shop where special equipment has been installed to permit rewinding of large streamline train motors and generators.

a fraction of its rating, could be rewired with a smaller wire. A motor known to be carrying a heavy load, dangerously near to its capacity, could be wired with larger wire and the job would run more efficiently as well as cooler.

Knowing that they could not buy wire whenever they wanted it and that it would be difficult to keep their inventory at the right level, this Tampa shop increased its efficiency and reduced waste by using up all odd sizes and scraps.

Thus it was found out that it could get along quite well on the reduced stock of wire but the increased volume of 150 per cent played havoc with the floor space and under normal conditions would have necessitated the building of another building.

Storage Problem Solved

This problem was solved by the building of "jeep buggies" and finding a storage space for these loaded buggies.

Essentially the jeep is a box on wheels in which motor parts are stored until the job is ready to be reassembled. They are numbered and the numbers are entered on the work ticket so the parts can be found. Here is the way it works:

A motor is disassembled. If the bearings or the shaft need metallizing, they go to the machine department; if the stator is to be rewound, it goes to the rewinding department. The remainder of the motor, the end bells, the screws, the armature and other parts have to be stored somewhere until it is ready to be assembled again. That is the function of the jeep buggy. The extra parts are stored in the jeep, and while the stator is being rewound, the other parts are being washed in the machine washing machine, which will be described later, and the cleaned parts in the jeep are stored in an annex, which keeps them from cluttering up the regular work floor.

Except for the part the jeeps are playing they would have needed three times the floor space, Mr. Turner said.

Along with streamlining and achieving of mass production methods at the Tampa Armature Works, it soon became apparent that dismantling and washing of motors was likely to become an expensive bottleneck.

This was how it happened that Mr. Turner devised the washing

(*Continued on page 54*)

Other time-savers in the Tampa Armature Works shops: (top) metallizing equipment in use; (center) turntable in washer where mineral spirits under pressure clean motor frames, etc.; (bottom) "jeep buggies" used for storage of motor frames and parts until ready for assembly.

Reconnecting Three-phase Motors For New Voltage Conditions

By A. C. Roe*

WITH the large motor manufacturers tied up producing electrical equipment for our fighting forces new motors will be hard to obtain even with the best priority rating. The motor repairman will be called upon to take existing motors and either reconnect or rewind them to suit different conditions. This article will present some data that can be used for reconditioning three-phase, lap wound a-c induction motors.

When rewinding any motor, first consideration should be to determine its load cycle and whether it will be subjected to continuous operation, i.e., 24-hours per day, six or seven days a week, or long overload periods? In such cases, use all Class B insulation and where possible increase the copper.

Roughly a change from Class A to Class B insulation will permit an increase in motor rating of from 8 to 10 per cent. Also for each 1 per cent increase in copper area, the motor rating can be upped a half of one per cent. For example, a 10 per cent increase in copper area permits an increase in horsepower rating of 5 per cent. If the winding is changed from A to B insulation, the total horsepower increase can be as much as 15 per cent. Thus the selling price of the rewind job can be increased in proportion, and the new winding will be able to withstand higher operating temperatures without failing or interrupting production.

Inasmuch as alternating current motors can be reconnected for different voltages by taking advantage of various series and parallel connections, and of star and delta arrangements in three-phase designs, it is important to know which connections are best suited to the stator construction and operating conditions. When rewinding a stator, there are even more combinations that can be used by varying the number of turns per coil and the coil pitch.

Quite often it is desired to reconnect the windings of an induction motor to operate on different line voltages or, when rewinding a stator, some bad feature in the coils or connections may be eliminated by changing the type of connections, the coil pitch, the turns per coil, and so on. It is the purpose of this article, therefore, to discuss the various changes that affect the voltage and to outline the possibilities of removing bad features as well as the effects of over and undervoltage on the operation of the motor.

To begin with, we can consider the stator winding of an induction motor as a generator. Then any change made that tends to increase or decrease the turns in series per phase will also increase or decrease the voltage in the same proportion and in the same direction as that in which the turns are changed. In applying this rule in practice we must remember, also, that when the turns per phase are changed more than 10 per cent, a corresponding change in the cross section of the conductor should be made in the same proportion, but in the opposite direction.

Reconnection Limitations

One important rule to remember when rewinding or reconnecting a motor is to keep the voltage per turn the same as it was originally if the horsepower, speed, frequency and number of phases are to remain the same. Also be sure that the new arrangement of the winding is within 5 per cent of the proper line voltage, if possible, and in any case, do not exceed 10 per cent either way. These figures can sometimes be exercised for intermittent duty and temporary jobs and will no doubt work satisfactorily, but for a good permanent job, keep within these limits. This can usually be done by changing the type of connection, the turns per coil, and the chord factor. Sometimes, however, it is not possible to keep the voltage the same. In such a case the effect of undervoltage or overvoltage must be considered.

Fig. 1. How short circuits often occur in cross-over shuttle-wound coils. At "A", the third turn is against side of shuttle providing ample space for the fourth turn. At "B", however, the third turn has slipped down between turns 1 and 2. The driving of turn 4 into place will cause shorts between 4 and 3 or 1, 2 and 3.

The most common voltage changes are from 220 volts to 110 volts, 220 to 440, 440 to 110, or vice versa in each case. On some stators this can be accomplished by reconnecting from series to two-parallel, etc., depending upon the number of poles, coils per phase, and the original connection. When the original connection is a series connection, it is obvious that the voltage can not be increased by reconnecting. In this case it is necessary to rewind the stator with the turns per coil increased in the same proportion as the voltage is to be increased. At the same time the size of wire (cir mils) must be decreased in the same proportion.

Do not attempt to raise the voltage of 110-, 220-, 440-, and 550-volt motors above 550 volts without rewinding, as the insulation to ground and between phases on motors of this voltage range is not sufficient to stand continuous operation at higher voltage. It may be possible to juggle the connections to get the desired voltage but this should not be done.

Another point to remember when making a voltage change is: Do not attempt to parallel the coils in any one pole-phase-group. This means that we cannot split a group in half and parallel the halves with each other. Each group could be split into two sections of two coils and these two sections put in parallel. However, if this were done circulating currents would be set up,

*Mr. Roe is motor engineer for Westinghouse Electric and Manufacturing Company.

because of the angular displacement of the different pairs of coils. If the motor were connected in this manner and put on the line, it would be found, in about ten minutes, that there were two hot coils, then two cool coils, alternately, throughout the winding. Therefore, when reconnecting, do not split the groups, but use them as units.

To help determine what connection to use to get the required voltage or what the line voltage should be with any other possible connection, Table I has been developed for three-phase motors having 2 to 12 poles. (Also, see tables in May 1943 issue, pages 44 and 48.) The table gives all the possible connections for the number of poles to which it applies. The first vertical column in the table gives the original connection; then each figure on the same horizontal line with any original connection is the multiple to be used to find what the line voltage should be with the connection listed in the top line.

Assume a 440-volt, three-phase, four-pole motor, series Y connected. On consulting Table I, we look in the first column and find the horizontal line in which the word "Series-Y" is located. Then the first figure is 1 and above this figure is the word "Series" which indicates that no change is made. But the second figure is .5 which indicates that with two-parallel Y connection the motor would have to operate at 440 x .5 or 220 volts.

Again, under "4-Parallel-Y" appears the figure .25. This signifies that with a four-parallel-Y connection, the line voltage would have to be 440 x .25 or 110 volts.

Another use of the table is to find the required connection for a certain voltage. Assuming the same motor as before, a 440-volt series-Y connection, suppose it is desired to change the voltage to 110. What connection would give the desired results? To find the factor divide the required voltage by the original voltage, or 110 440 = .25. In doing this be sure about the position of the decimal point. Then, looking along the original connection (series-Y horizontal line), we locate .25 under "4-Parallel-Y" which connection will give the required voltage.

For three-phase stators the table is found particularly useful, as there are two types of connection possible: namely, Y and delta, indicated by D in the table. This gives a greater range of combinations. In any Y-connected machine, the voltage per phase is equal to line voltage divided by 1.73. In other words if a series, Y-connected motor is operating on a 220-volt three-phase line, the volts per phase will be 127. This motor could be connected series-delta and operated on 127 volts which is approximately 58 per cent of the series-Y line voltage. Conversely, a 110-volt, series-delta-connected motor could be connected series-Y and operated on 1.73 x 110 or 190 volts. A few actal examples will be given to show the use of the table.

(Continued on page 53)

Table I.—Reconnection Chart for Three-Phase Induction Motors, 110 to 550 Volts

The numbers in the body of the table are factors by which the original voltage must be multiplied in order to find the proper voltage for the new connection. For example, if the original connection is a 6-parallel delta and it is desired to reconnect it to 5-parallel-Y, the proper factor is found by locating the original connection in column at left and looking to right on this line under the column headed by the desired new connection. The factor is found to be 2.08 and this indicates that the voltage of the new connection will be 2.08 times the voltage of the original connection.

Original Connection	New Connection																	
	Series		2 Par.		3 Par.		4 Par.		5 Par.		6 Par.		8 Par.		10 Par.		12 Par.	
	Y	D	Y	D	Y	D	Y	D	Y	D	Y	D	Y	D	Y	D	Y	D
Series Y	1.00	.58	.50	.29	.334	.193	.25	.145	.20	.116	.167	.096	.125	.073	.10	.058	.083	.048
Series D	1.73	1.00	.865	.50	.576	.334	.432	.25	.346	.20	.288	.167	.216	.125	.173	.10	.145	.083
2 Parallel Y	2.00	1.16	1.00	.58	.667	.386	.50	.29	.40	.232	.334	.192	.250	.146	.20	.116	.166	.096
2 Parallel D	3.46	2.00	1.73	1.00	1.15	.667	.865	.50	.692	.40	.576	.334	.432	.250	.346	.20	.290	.178
3 Parallel Y	3.00	1.74	1.50	.87	1.00	.580	.75	.435	.60	.348	.501	.288	.375	.219	.30	.173	.249	.144
3 Parallel D	5.19	3.00	2.60	1.50	1.73	1.00	1.30	.75	1.04	.60	.864	.501	.648	.375	.519	.30	.435	.249
4 Parallel Y	4.00	2.32	2.00	1.16	1.33	.772	1.00	.58	.80	.464	.668	.384	.500	.292	.40	.236	.332	.192
4 Parallel D	6.92	4.00	3.46	2.00	2.30	1.33	1.73	1.00	1.39	.80	1.15	.668	.864	.500	.692	.40	.580	.332
5 Parallel Y	5.00	2.90	2.50	1.45	1.66	.965	1.25	.725	1.00	.58	.835	.480	.625	.365	.50	.290	.415	.240
5 Parallel D	8.65	5.00	4.33	2.50	2.88	1.66	2.16	1.25	1.73	1.00	1.440	.835	1.08	.625	.865	.50	.725	.415
6 Parallel Y	6.00	3.48	3.00	1.74	2.00	1.16	1.50	.870	1.20	.696	1.00	.576	.750	.438	.60	.346	.498	.288
6 Parallel D	10.38	6.00	5.19	3.00	3.46	2.00	2.60	1.50	2.08	1.20	1.73	1.00	1.296	.750	1.04	.60	.870	.498
8 Parallel Y	8.00	4.64	4.00	2.32	2.66	1.54	2.00	1.16	1.60	.928	1.34	.768	1.00	.584	.80	.464	.664	.384
8 Parallel D	13.84	8.00	6.92	4.00	4.60	2.66	3.46	2.00	2.76	1.60	2.30	1.34	1.73	1.00	1.38	.80	1.16	.664
10 Parallel Y	10.00	5.80	5.00	2.90	3.32	1.93	2.50	1.45	2.00	1.16	1.67	.960	1.25	.730	1.00	.58	.830	.480
10 Parallel D	17.30	10.00	8.66	5.00	5.76	3.33	4.32	2.50	3.46	2.00	2.88	1.67	2.16	1.25	1.73	1.00	1.45	.830
12 Parallel Y	12.00	6.96	6.00	3.48	4.00	2.30	3.00	1.73	2.40	1 39	2.00	1.16	1.50	.876	1.20	.692	1.00	.576
12 Parallel D	20.76	12.00	10.38	6.00	6.92	4.00	5.20	3.00	4.16	2.40	3.46	2.00	2.58	1.50	2.08	1.20	1.73	1.00

PRACTICAL HELPS for the TRADE

Contractor - Dealer - Motor Shop

Service Station Lift Handles Heavy Equipment

When a gasoline service station near the Nolin Brothers Refrigeration Company, in Montgomery, Alabama, went out of business, Manager A. C. Nolin saw an opportunity to solve a serious wartime problem in repairing and overhauling commercial refrigerated cases, air conditioning equipment, etc.—the slowness of getting such heavy equipment off a truck and into the repair shop.

When the service station sold its equipment, Mr. Nolin bought the grease rack lift, and had it installed in a concrete foundation just outside the cement apron leading into the repair shop. Equipped with a strong platform of two-by-six wooden planks, and capable of lifting ten tons, this rack now has reduced by hours the time required to load and unload refrigerating equipment at the shop. Formerly the trucks backed up as near the door as possible, and its contents were slid laboriously down heavy planks, requiring several men to get it inside the shop.

Now, the two steel strips form a platform which lifts easily to the height of the truckbed, bearing a heavy caster-wheel dolly which is locked in place with a single hook and eye "gadget." The load is then pushed on to the dolly, and after being secured, the lift is lowered to the ground, and the whole thing pushed without effort into the shop for repair work.

The lift can be swung around in a complete circle, making it equally useful for unloading small half-ton trucks as well as larger ones, and its flexibility makes it the most convenient time-saver the firm has ever developed.

Novel Plan for Storing Small Repair Parts

Shown in the accompanying photograph is the small appliances servicing workbench of Woodruff's, Knoxville. W. G. Dail is repairing an electric toaster. Notice the idea of jars underneath the board shelf. The caps of the jars are nailed underneath the board and it is easy to screw or unscrew the jars on the caps. They are handy for small items and yet are out of the way.

Woodruff's has other work benches for other kinds of electrical servicing. An entire small building, apart from the main store, is given over to service departments. There are service departments for small appliances, major appliances, stokers, and radios.

Specialists from different departments of Woodruff's were among those who talked and gave demonstrations at the recent Electric Appliance Servicing School in which Knoxville dealers cooperated.

Repairing Open-type Heating Elements

A weld costing less than a penny is used by Henry Moses, of Moses Electric Co., electrical contractors, Knoxville, Tenn. It not only saves money and does a good job, but it helps conserve vital war materials in electrical heating units.

The unit should be cleaned with any good cleaner. Snip off burrs that may have been left by the arc. Mash the coil two turns, see that connections are tight, sprinkle lightly with soldered flux, and turn on heat. Allow heat to stay on about one minute. Then with the end of a clean paddle or stick remove the remaining powder, turn on heat again, sprinkle lightly again with welding flux. When that is burned up, the welding job is complete.

It makes a neat weld and no air can pass between the turns of the coil. That not only insures a good weld, but an even distribution of heat. No dark spots will appear in the coil and the repaired section will last as long as any other part of the coil.

It is important to be sure that the coil is free from grease or any other foreign substance which would prevent a weld.

That type weld makes possible

reclaiming old units which would be thrown away otherwise.

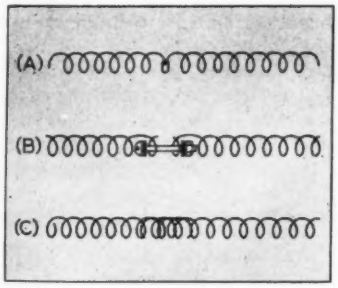
That method has proved successful on all nichrome wire wound units.

J. W. Goans, Knoxville dealer-coordinator, introduced the idea there. "On one test alone we had an open coil unit, in an electric range oven, which was welded in November, 1942," he said. "The weld is still holding and the even distribution of heat in the oven is just as efficient as it was before the coil burned out. If the appliance service men will use this method, with a little practice they will be able to give a quick and efficient weld on all types of open coil units.

"As service men will remember, we had makeshift methods of repairing open coil units. One is familiar to most service men. That is twisting the wire, which necessitates opening the coil further than is permissible. This method allowed oxidation to set up in the connection, also increased the resistance of the coil, shortening the life of the coil and retarding the efficiency of heat distribution.

"Another familiar method to most service men was the use of so-called sleeves. These not only proved to be cumbersome, but not very efficient. In clamping the sleeve on the wire, a loose connection was sometimes made, causing an arc to set up, scaring the housewife and reducing the life of the entire coil.

"Another very familiar method was the use of a machine bolt, with one lock washer and two nuts. This new method now being used will eliminate the nuts and bolts and sleeves, with the exception of where an unusual strain is placed on the unit, such as a toaster or other type of ribbon heating unit. It will also reduce the cost of repairs to the homeowner, by reducing the labor cost, the cost of new coil, and the time the customer is without the use of appliance. It is one of the major factors in saving critical war materials."



All open coil units wound with nichrome wire can be serviced unless completely burned up. Shown above are three methods: (A) Use of a sleeve. This can be constructed out of any durable metal (preferably copper). Construct sleeve large enough to insert the open ends of the coil, close sleeve until only a small opening remains, apply 230 volts a-c and sprinkle welding flux; while current is welding, close the sleeve. (B) Coil loop in each end of opening on coil, use small machine screw with flat head and lock washer on each end of screw. Insert screw through the loops; tighten enough to make good contact, apply voltage, sprinkle on flux and while this is welding, tighten nuts. (C) After ends of coil are cleaned where opening occurred, take each end of coil and mesh two turns. Apply voltage; sprinkle welding flux on ends where mesh is made. This will make an excellent weld and will last the life of the coil.

Henry M. Moses, of Moses Electric Co., Knoxville, is demonstrating a weld job on a coil unit. He has just cleaned it and is putting on a pinch of soldered flux from the box at right.

Package 'Checkup Service' Promotes Service Business

Former major appliance dealers now operating refrigeration service during war time and finding returns a bit slim will find greater profit possibilities in merchandising a "package checkup job" according to one Southern dealer now entering his second year in the field.

The firm, Modern Appliance Company, Memphis, has eight servicemen handling domestic refrigeration, air conditioning and even commercial installations, as well as a heavy volume of small appliance repair work in the shop itself. The old showroom space has been turned into a parts room, and most of the employes of the former sales organization have been retained. Though store income is much less than before the war, there is ample profit to maintain it efficiently—through selling a complete checkup service at $10 on domestic refrigerators; higher, on commercial equipment.

"We have trained all our servicemen in salesmanship to some extent," the manager said, "giving them enough skill to follow up a housewife's natural concern in the refrigerator which is now so hard to replace. For the past eight months, each man has been asked to suggest and sell a complete overhaul of the box, covering every part of it, for $10, on the basis that it will guard against future repair calls and eliminate costly breakdowns in advance."

The package job consists of ten points, including an inspection of all electrical connections, adjustment and oiling of the motor, inspection of the platform, a check on the expansion valves and coils, cleaning of the condenser, and step by step adjustment of all operating parts. It requires more than an hour on the average refrigerator, and servicemen have been instructed to put in enough time on even the best-condition refrigerator to justify the customer's cost.

"We were getting far too many small repair jobs which barely covered the cost of sending a man out," the manager pointed out. "Although our hourly rate is the same as other firms here, it was not really profitable to continue unless we could command more income. After a few months of experimentation, we discovered that women are highly conscious of the precious nature of their refrigerators, and willing to consider the checkup job just as their husbands are spending more for automobile maintenance."

Now, the serviceman from the company arrives at the house, inspects the refrigerator, and as soon as he has located the original trouble, points it out to the housewife with the explanation that if it had been adjusted properly some time before, there might have been no need for him. This makes an excellent basis for recommending to the housewife that she let Modern Appliance Company completely tune-up the refrigerator there and then at the flat price of $10. Less than one-

quarter of the total number of customers called upon turn down the suggestion — proof that news of metal parts shortages and other supplies has penetrated deeply into the average woman's mind.

Consequently, Modern Appliance Company spends a little more time on every call, "merchandises" its check-up service, and has more than doubled the profit-per-call in every instance.

What Makes a Lamp Starter Start!

The purpose of the fluorescent lamp starter is to act as a time delay switch which will connect the two filament type electrodes in each end of the lamp in series with the ballast during a short preheating period when the lamp is first switched on. It then opens the circuit and, since the preheating causes emission of the electrons from the active material coated on the electrodes, it is possible to strike the lamp arc without the use of an excessively high voltage.

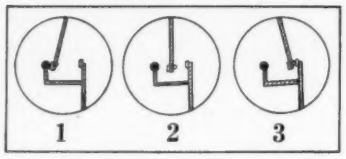
The starter described here is a modified thermal type which has the advantage of accurate timing to insure positive and adequate preheating of the electrodes, and yet overcomes, by use of two internal contacting elements, the disadvantages of slow restarting.

1. Starting Position. The bimetal strip is shown resting against the carbon starting contact — the position it normally assumes when lamp is not operating.

When the line switch is closed, the preheating current at once flows through this contact and the heat developed, because of the high contact resistance at this point, causes the bimetal strip to open the circuit and thus light the lamp after the electrodes have been properly reheated.

2. Operating Position. During lamp operation the bimetal strip is balanced in a position midway between the two contacts. This balance is maintained because of the heat developed in the high resistance heating element which is connected across the lamp and is thus subjected to the same voltage as lamp.

3. Restarting Position. If the lamp is momentarily turned off and then turned on again, the high resistance heating element is subjected to full line voltage and the additional heat causes the bimetal



strip to move over until it closes the restarting contact. As soon as this occurs, the high resistance heating element is short circuited so that no current flows through it and therefore no heat is developed and the bimetal strip begins to cool off. At the same time, the starting current begins to flow to heat the electrodes and this continues until the bimetal strip cools enough to break the contact and light the lamp.

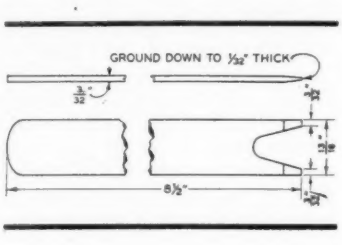
The starter is compensated for the effects of surrounding temperature thus permitting operation over a wide range of temperature conditions. The design of the starter also insures positive operation over a wide voltage range. A small condenser is connected in parallel with the starter contacts as an aid in reduction of radio interference.

Wrench for Removing Fan Bearings Useful

Finding it difficult to remove the retaining (or locking) ring in order to replace bearings in G-E fans, Fred Stevenson, owner of Acme Electric Company, Miami, Fla., has designed a wrench to make the job an easy one.

Salvaging from his scrap box a piece of nickeled steel, 3/32" by 13/16" by 8-1/2", Stevenson ground a slot of elongated, ovoid shape at one end. The prongs which fit the slots in the retaining ring are 3/32" wide and 1/32" thick at their tips. Making the ground slot in the shape described gives the tool greater torsional strength than if made rectangular.

This wrench may be used for removing either front or rear bearings. It is handy also for the same purpose in repairing fans of Century, Hunter and several other manufacturers.



The corners of the tool at t end opposite the slot were roun ed and the edges smoothed up avoid any danger of cutting t hand when the wrench is in use

How to Maintain Oil Circuit Breakers

To prevent costly failures an delays in operation, it is impor ant for the starting breaker t function properly when an emer ency arises. To accomplish this r liability, it is necessary that th breaker receive periodical, tho ough inspection and maintenanc

Motor starting, oil circuit breal ers are designed for general star ing service. When properly ap plied they protect the motor fro overloads, short-circuits and guar against the sudden application full voltage to the motor after has come to rest.

The frequency of inspectio and maintenance depends upon th severity of the duty which th breaker must perform and the co dition of operation. Usually a ligh monthly inspection with a tho ough inspection and maintenanc semi-annually should be satisfac tory. However, in some case breakers operating under very ac tive and severe service may re quire more frequent attention Other breakers that operate in frequently, and under less sever duty, will naturally require les attention. The frequency of in spection will be largely determ ined by experience.

Ten Points to Check for Proper Maintenance.

1. Before making any adjust ment to an oil circuit breaker make sure that all lines leadin to it are electrically dead.

2. Be sure the breaker fram is grounded.

3. Do not operate the breaker excessively by the electrical oper ating mechanism when the oil tan is removed.

4. Examine all contacts freq uently, especially after sever short circuits, to see that contact are properly aligned. Dress or re place contacts that are burned.

5. After making adjustments test the breaker by hand to mak sure that it operates smoothly an correctly.

6. Inspect the oil regularly an after severe short-circuits. If i shows signs of moisture, carbon

ization or dirt, filter and retest it before replacing it in service. See that the oil level in the tanks is maintained at the proper height.

7. Remove all oil and thoroughly clean the tanks, tank liners, lift rods, and terminal bushings at least once a year.

8. Thoroughly inspect all bolts and nuts; tighten if necessary. Inspect all pins, links and bearings for excessive wear. Check all cotter pins.

9. Dielectric tests of the oil should be made every three months, to show if it is reasonably good for circuit breaker work. Samples should not be taken until the oil has remained undisturbed for at least four hours. If testing for indication of wear, take the sample from the bottom of the tank. For indication of carbon and after a heavy short-circuit, take the sample from the surface of the oil.

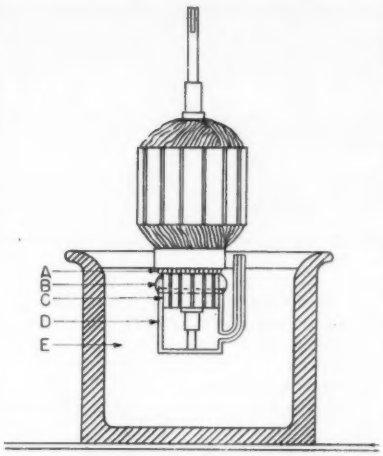
10. Arrange for regular inspection to see that the circuit breaker is in adjustment, the oil of good quality and the complete breaker functions as required.—*By N. P. Wilson, Westinghouse Elect. & Mfg. Co.*

Preventing Splatter In Dip Soldering

A simple but effective protective sleeve devised by Donald Butter, a plant engineer at General Electric's Schenectady Works, prevents molten solder from spattering on the operator or adhering to the body of the commutator or shaft when dip-soldering leads of small generator rotors into the slots of the commutator segments.

The sleeve consists of a cup formed of thin sheet steel with welded joints. A piece of 1/4-inch standard pipe inserted and welded into the side of the cup near the bottom extends up along the outside to a point high enough above the cup so that it protrudes above the solder when the commutator is submerged. The pipe acts as a vent to carry off any steam or vapor that may generate when cold metal is submerged in the molten solder.

The cup is made with a slide fit so that it may be assembled on the commutator snugly, but without bending. It covers the shaft end and about three-quarters of the commutator body. The joint between the commutator body and the cup is taped, sealing it to prevent



A – Commutator leads to be soldered
B – Friction Tape Seal
C – Commutator
D – Protecting Sleeve
E – Solder

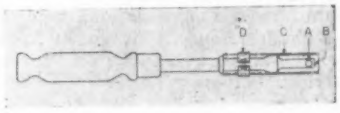
the entrance of molten solder. The entire rotor is suspended in a vertical position, with the commutator down, on an electric hoist directly over the solder pot. The commutator end with sleeve assembled is completely submerged in molten solder, covering the slots and lead ends. The rotor is left in this position until the leads are thoroughly sweat into the slots, then it is hoisted. The sleeve is easily removed with asbestos gloves, and the rotor is placed on a table to cool.

Special Iron Simplifies Small Wire Soldering

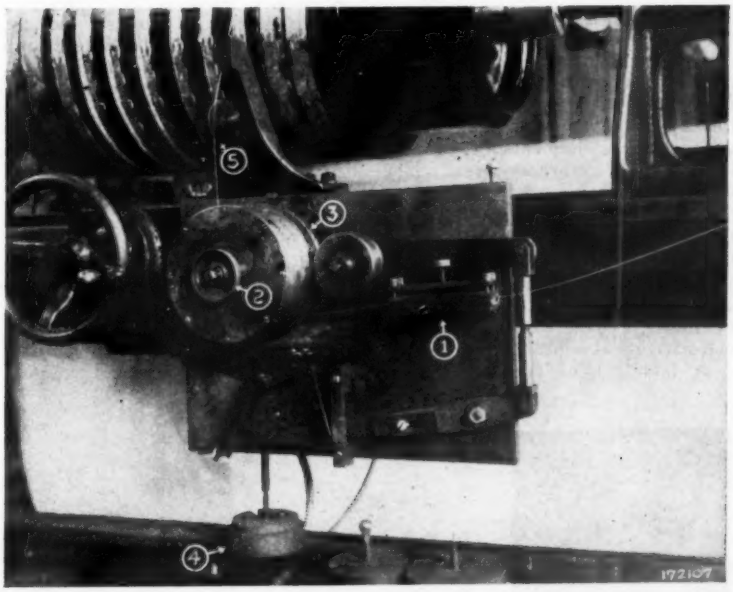
The job of soldering small wire connections may be simplified by making the iron stationary and dipping the connections into a small hole filled with solder near the tip of the iron.

As shown by the drawing, the soldering iron can be fixed for use in this manner by drilling a hole (A) into the tip (B). A nickel steel tip will last longer than other types.

The drip and splash guard (C)



catches surplus or drips of solder coming off the iron. It is made of 1/32-inch steel and is fastened to the iron with a hose clamp (D).



TENSION DEVICE FOR BANDING OPERATIONS—The application of steel banding wire to rotors is greatly simplified by this anti-friction tension device. Various tensions can be obtained without heating the wire. The operation of the device is readily understood from the photograph. (1) Wire guide and straightener. (2) Friction nut. (3) Wire drum about which wire is wrapped three times. (4) Tension weights operating through lever system shown. (5) Wire guide. Anchor clips are just barely discernible. Steel wire is applied over insulation.—A.C.Roe.

NEWS of the INDUSTRY
National and Southern

Manpower Replacement Industry's Big Problem

"Essential industries will lose as many men to the armed forces this year as they have lost hitherto all together through induction by selective service," Brigadier General William C. Rose, chief, Executive Services, War Manpower Commission, warned more than 600 members and guests attending the spring meeting of the National Electrical Manufacturers Association, held at the Palmer House, Chicago, in April. General Rose, who spoke on "Inventorying Manpower," added, "We cannot prevent this loss, but we should plan for replacement."

He declared that over two million must be added to our working force this year, and over four million to the armed forces. This is a total additional requirement, General Rose emphasized, of nearly six and one-half million, two-thirds of whom must be able-bodied men meeting the physical and other requirements of the armed forces. Most of these men must be drawn from the labor market, and all such must be replaced by other workers, while at the same time we are meeting the expansion requirements of two million plus other workers already mentioned.

General Rose urged war industries to adopt the voluntary Manning Table Plan, and its adjunct the Replacement Schedule, to aid them in working out an orderly and effective cooperative system for handling their selective service problems.

A highlight of the spring meeting luncheon was the presentation of Fifty Year Certificates to three NEMA members. President Max McGraw read citations and presented the certificates to Fred B. Adam, president, Frank Adam Electric Co., St. Louis, Mo.; Charles Edward Brown, executive vice president, The Okonite Co., Chicago; and Charles K. King, president, The Ohio Brass Co., Mansfield, Ohio.

NEMA Members Organize Service Training Programs

Women are now being recruited in every one of the 48 states to help keep the nation's 19,000,000 electrical household refrigerators operating efficiently to prevent waste of any vital foods, it is announced from the headquarters of the National Electrical Manufacturers Association.

Charles R. D'Olive, chairman of the Household Refrigeration Section of NEMA, reported that many major manufacturers of electric refrigerators have organized service training programs in which women as well as older men and boys are filling the ranks of skilled appliance service men who are now in the armed forces. In addition, the industry is sponsoring educational programs to train the women in the homes to lengthen the life of their refrigerators.

"This program," said Mr. D'Olive, "is designed as an aid to dealers employing service staffs and to the customers served." There are, he said, three main objectives:

1. Help dealers provide dependable service by training service workers and by providing renewal parts.

2. Promote conservation of renewal parts by showing service staffs how to repair old parts, and by re-operating old and worn parts which are returned to the factories. As a part of this program, when ordering certain new parts, dealers must return the old parts to the factory before replacements can be had.

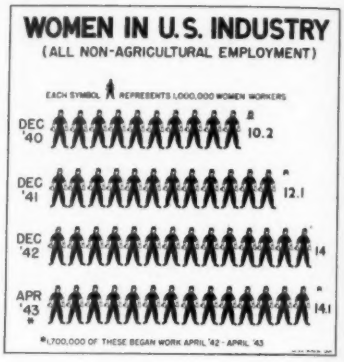
3. Educate customers in the proper care and use of refrigerators to lengthen the life of the appliance and prevent needless service calls.

One manufacturer has published and distributed more than 20,000 copies of a simplified training service course, together with an instructor's manual. This course has been used by many utilities and vocational and trade schools in preparing recruits for service work.

Customer instruction folders have been prepared by the manufacturers to help the user make simple adjustments without calling a service man. Another company has distributed a trouble shooter's guide containing answers to most frequent questions on refrigerator operation. The guide was designed for service department information desks and has been responsible for eliminating many unnecessary service calls.

Reflecting the industry's efforts to conserve the supply of spare parts, one company reports, that today they are rebuilding approximately as many parts as they are shipping. Another company states:

"The use of renewal parts is held to a minimum by making repairs of used parts. Wherever possible, parts in less demand are used as substitute



Fred B. Adam

Charles E. Brown

Charles E. King

replacements for parts in greatest demand. Also, when any part, such as a motor or control, is replaced, it is returned to the factory for reconditioning or reclaiming of any of its integral parts".

Industrial Power Salesmen To Hold Spring Conference

The Spring Conference of the Industrial Power Committee of the Southeastern Electric Exchange will be held in Atlanta at the Henry Grady Hotel, on June 23 and 24, according to announcement by John W. Talley, executive secretary of the Exchange.

The Industrial Power Committee, headed by P. D. Lawrence, will present a program concerned principally with those problems which the companies are encountering in connection with the war effort.

Duke Power Company to Purchase Durham Utility

The Duke Power Company announced on May 13 that it has entered into a contract with the Durham Public Service Company, at Durham, N. C., for the purchase of the company's properties, including its electric and motor bus properties in Durham and vicinity. The contract is conditional upon approval by the necessary Federal and State commissions.

This was disclosed when representatives of Duke Power Co. appeared before the City Council at Durham and obtained 30-year electricity and transportation franchises. The amount to be paid for the properties and holdings was not announced.

Appearing before the Council to make application for the franchises were: E. C. Marshall, of Charlotte, N. C., vice-president of the Duke Power Company; W. S. Robinson, of Charlotte, general counsel of the Duke Power Company; Jones Fuller, of Durham, Duke Power attorney; and R. L. Lindsey, vice-president of the Durham Public Service Company.

It was announced that Lindsey will continue to direct the Durham company and that the present personnel will be retained. Sale of the properties by Cities Service has been ordered by the Securities Exchange Commission, it was said, because the company is an isolated holding of the Cities Service system. Application to the North Carolina State Utilities Commission, the Securities Exchange Commission, and the Federal Power Commission for approval of the transfer will be made at an early date.

"The Durham Public Service Company, by reason of the Public Utility Holding Company Act and the orders of the Securities and Exchange Commission, is under the necessity of disposing of its properties," Vice-President Marshall of Duke Power declared in a letter to the Durham City Council requesting the franchises. "For this reason Durham Public Service Company took up with Duke Power Company some time ago the matter of Duke Power Company purchasing these properties. As the result of these negotiations Duke Power Company has entered into a contract with the Durham Public Service Company for the purchase of that company's properties, including its electric and motor bus properties, in the city of Durham and vicinity."

Higher Rating Required To Obtain Certain Lamps

To maintain control over distribution of incandescent, fluorescent and glow discharge lamps, and to assure equitable distribution of electric light bulbs for home use, Order No. L-28 was amended in May by WPB.

Effective immediately, under the amended order, only ratings of AA-4 or higher can be applied or extended for purchase of incandescent, photoflash, photoflood, fluorescent, and glow discharge lamps. Previously, an AA-5 rating was acceptable.

Today's action was necessary because as a result of the amendment Friday of CMP Regulation No. 5, commercial users now are automatically assigned AA-5 ratings for these products and other operating supplies. If the AA-5 rating had been allowed to stand for purchase of bulbs and lamps, stores, theaters, restaurants, etc., would have had an advantage in purchasing, possibly bringing undue hardship to residential users of light bulbs.

Under the terms of L-28 as amended today, commercial and residential requirements are expected to be supplied equitably.

No preference ratings are required for the purchase of electric lamps. WPB is authorizing lamp manufacturers to ship lamps to jobbers and dealers for sale on unrated orders. The ratings aid essential users when supply is inadequate and priority over less essential bidders is required.

Armored Cable Defined in WPB Order

The War Production Board has clarified the definition of "armored cable" as covered in Limitation Order L-165, to read as follows:

" 'Armored cable' means a fabricated assembly of electric conductors with a flexible metallic exterior covering, which covering is formed of a metal strip helically wound with interlocking edges. Armored cable shall include, but is not limited to, armored ground wire, or armored electrical conductors irrespective of whether the conductors of such armored cable are bare, insulated, lead covered, cloth covered, varnish-cambric covered or paper covered."

FUSE REPLACEMENTS IN ONE LESSON—Typical of several demonstration boards on display at branch offices of Duke Power Company, this one at the Gastonia office gives the fuse story in one easy lesson—and an opportunity to make fuse replacements. Appliance Supervisor Chas. M. Stone reports great interest on the part of customers, some of whom have expressed their appreciation for this information.

SYLVANIA *proudly announces*

MORE LIGHT FROM LESS WEIGHT

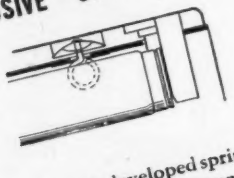
Sylvania pioneered composition reflectors for fluorescent fixtures and "proved them in industry."

This composition reflector has an efficiency of 86 per cent—even higher than that of prewar porcelain-enameled metal in conventional contours.

It is fabricated to Sylvania's specifications from a strong and durable composition. Coated with MIRACOAT inside and a handsome French Gray outside, it stands up under extreme humidity and temperature conditions. Also it is impervious to frequent washings.

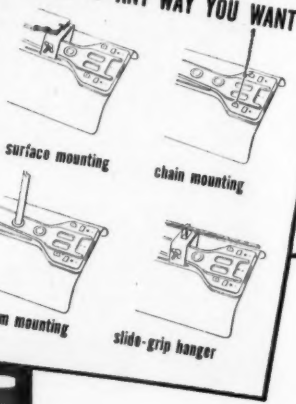
It gives more light. It's lighter and easier to handle.

EXCLUSIVE "CAPTIVE LATCH"

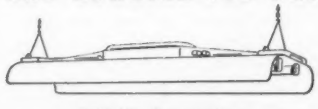


This Sylvania-developed spring-type fastener saves installation and maintenance man-hours. It stays put while lamp is in service despite any kind of vibration. It locks or unlocks with a simple quarter turn. No tools are necessary.

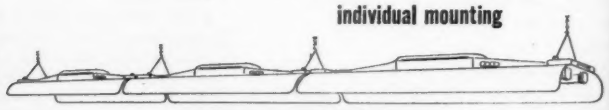
HANG IT ANY WAY YOU WANT



AND HOWEVER YOU WANT



individual mounting



continuous row installation

THE FLUORESCENT FIXTURE OF THE FUTURE!

- EASIER INSTALLATION
- SPEEDIER MAINTENANCE
- SINGLE OR CONTINUOUS ROW INSTALLATION
- SIMPLE
- STANDARD
- REGULAR SIZE USES 2 OR 3 40-WATT LAMPS
- LARGE SIZE USES 2 100-WATT LAMPS

This adds up to a modern, standard, adaptable fluorescent fixture that eliminates installation headaches and stock troubles.

HERE'S what you've been hoping for—years ahead of time—a fluorescent fixture that has "everything"—the fixture of the future NOW.

Once again Sylvania engineers have taken another long step forward, and designed a unique industrial fixture without metallic reflector, with top-housing under three pounds. Their perfected design is a revelation of simplicity and adaptability.

This new Sylvania fixture is made in two sizes—for 100-watt and 40-watt lamps. In either length, *one* standard fixture will fill any industrial lighting requirement.

. . . Can be installed singly or in continuous rows.

. . . Can be stem-mounted, surface-mounted, mounted with chains or slide-grip hangers.

. . . Can take either two or three lamps.

This one-for-all-purpose adaptability is attained by the streamlined top-housing that encloses the ballast, protects it and provides cooler performance. One-half-inch center knock-outs at centers of 18, 24, 30 and 36 inches provide for any type of mounting. The starter sockets are readily accessible, and there is a convenient knock-out for a pull-chain switch if desired.

This is the fluorescent fixture of the future that the trade has been waiting for. It meets all WPB requirements, carries Underwriters' Laboratories approval and our own standard guarantee. For specifications and prices, write Dept. X-00, Sylvania, Ipswich, Mass.

"Everything that's Finest in Fluorescent"

SYLVANIA ELECTRIC PRODUCTS INC.

Fluorescent Fixture Division, Ipswich, Mass.

INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, RADIO TUBES, ELECTRONIC DEVICES

This set of five new 1943 Service Guides are sent without charge by Hotpoint distributors to retail outlets and repair men who service Hotpoint major electric appliances. Designed to provide the seasoned service man with many important helps, they are invaluable to the novice as well.

New Pocket Guide Books Help Service Hotpoint

Hotpoint's Product Service Division has just released a set of five new 1943 Service Guides, pocket size, to be sent without charge by Hotpoint distributors to retail outlets and repair men who service Hotpoint major electric appliances. There is one book each for range, refrigerator, home laundry, kitchen sanitation and water heater, with covers of different colors for easy identification.

These Guides have been compiled from the best experience in peacetime and war-time servicing of Hotpoint electric appliances. They contain the best of all previous service data and give quick information for finding and correcting anything that needs attention.

Profusely illustrated, these books feature cut-away sections, diagrams and other information required by service men. They are designed to provide the seasoned service man with many important helps. For the novice, they are invaluable. They shorten time and quicken the road to satisfactory service. Quantities of Hotpoint's new Service Guides are now in the hands of Hotpoint distributors.

Synthetic Rubber Booklet Available

United States Rubber Company, which recently placed in operation the world's largest synthetic rubber plant, has used all available types of synthetic rubber in its products since 1932, according to a booklet, "The Five Commercial Types of Synthetic Rubber", released by the company in May.

Compiled for sales engineers of the rubber company, the booklet has been called the first technically accurate statement of the overall synthetic rubber situation which can be understood by the layman.

It traces the development of synthetic rubber from its laboratory beginnings, describes the properties of the commercial synthetic rubbers, and relates briefly the part played by United States Rubber Company in their development, manufacture and use in its products.

The publication includes photographs of synthetic rubber manufacture, many diagrams, and a chart compiled from the experience of plants and laboratories of the company, giving the relative physical and chemical properties of natural rubber and of the five types of synthetic rubber.

The booklet, which has had a limited distribution to government agencies and allied industry, has been cited for study by several of the foremost technical schools and colleges of the country, and is now made available free upon application to the United States Rubber Company, Synthetic Rubber Division, 1230 Sixth Avenue, New York City.

Order Permits Portable Lamp Manufacture

Manufacturers of portable electric lamps may produce such articles from parts which had been wholly or partially fabricated by Deecember 10, 1942, the War Production Board has provided in Limitation Order L-33 as amended May 1. Such production may continue until July 15. After that date production again will be prohibited except for orders of the Army, Navy, Maritime Commission, and War Shipping Administration.

Under Order L-33 as amended, restrictions of Copper Conservation Order M-9-c do not apply to specified parts that were in a manufacturer's car or his suspplier's inventory on December 10, 1942.

Temporary allowances also are made for renewed production of shades. Beginning today and until July 15, a manufacturer may use silk which was in his inventory on March 23, 1942. Iron and steel in the form of wire or wire frames, and phenolic plastics, which were in his own or his supplier's inventory on December 10, 1942, also may be used.

Under L-33, portable electric lamp production was stopped, except for military orders, on December 10, 1942. The stop date for shades, under the same order, was January 1 of this year.

Pre-war annual production of the lamps has been estimated at 30,000,000; and shades, about 50,000,000. Some 600 companies were engaged in the production of these articles.

L-33 as amended today is expected to provide relief for many manufacturers who had filed appeals with the Consumers Durable Goods Division and the Copper Division for permission to assemble prefabricated parts into lamps and shades.

Motor Limitation Order Revised Again by WPB

A number of changes are made in the provisions controlling production and delivery of electric motors and generators by General Limitation Order L-221 as amended by the War Production Board recently.

Among the changes made are the following:

The definition of electric generators covered by the order is changed to exclude certain high-powered generators now controlled by WPB's Power Division.

Operating spares are excluded from the restrictions on idle equipment but such spares are limited to the amount specified in the order that any one person can hold and still be permitted to purchase new motors.

Reference is made to the services performed by the Used Equipment Section, Electric Equipment Branch of the General Industrial Equipment Division in assisting purchasers to locate used motors or generators.

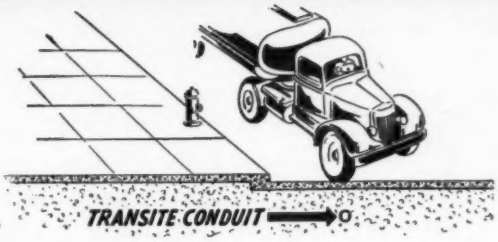
Restrictions on the types and designs of motors and generators that may be manufactured and delivered are changed in minor respects.

The certification submitted by the dealer is simplified and the standand form adopted is attached to the order in Appendix A.

Purchases of motors by the Maritime Commission for use on shipboard are exempted from the order.

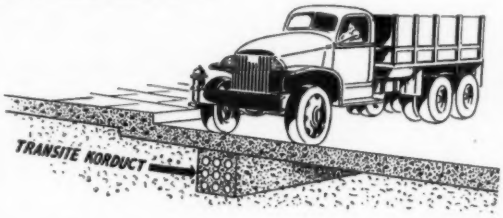
WHY *TWO TYPES* OF *TRANSITE DUCTS*?

For Use Without a Protective Envelope . . .



Transite Conduit saves on labor and material, for it is so strong it needs no protective casing. It maintains its strength and true form under heavy earth loads and traffic pressure. Can't rot . . . effectively resists soil corrosion, smoke and fumes.

For Use With a Protective Casing . . .



Transite Korduct is thinner walled, lower priced, otherwise identical with Transite Conduit. Its long lengths mean fewer joints, fewer spacers. And its unusually high rate of heat dissipation lowers cable operating temperatures, boosts system capacity.

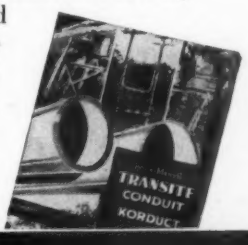
BOTH THESE DUCTS PROVIDE THESE ADVANTAGES AS WELL . . .

1. Minimize fire hazard—Transite Ducts cannot burn because they are made of asbestos and cement. They will not contribute to the formation of explosive or combustible gases.

2. Eliminate electrolysis problem—Inorganic and non-metallic, Transite Ducts can never be affected by electrolytic action.

3. Make cable pulls easy—The smooth bore of Transite Ducts speeds up cable installation. Because the ducts stay smooth in service, cables can be removed and replaced at any time with virtually no damage to sheathing.

4. Save time on installation—Light in weight, supplied in long lengths, Transite Ducts are so easy to assemble that only the minimum of time and expense is required for any job. Write for Data Book DS-410, Johns-Manville, 22 E. 40th St., New York, N. Y.



Johns-Manville

TRANSITE DUCTS

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

Under the previous version of the order only purchases of above deck motors were exempted.

Coincident with the publication of the amended order the War Production Board today issued Interpretation No. 1 of L-221 classifying floating dry-docks as vessels. Under the terms of the order, electric motors and generators for use on any vessel are exempted from the limitations and restrictions imposed.

Appliance Repair Movie Announced by G-E

The rapidly increasing importance of training household appliance repairmen has resulted in the adoption of movies for the first time to supplement sound slide films in demonstrating step-by-step details of repair, it is announced by the Product Service Division of General Electric Company's Appliance & Merchandise Department, of Bridgeport, Conn.

First movie is called "Know Your DR", and is designed to show proper procedure in the repair of the DR type of refrigerator mechanism. The DR unit was introduced by General Electric in 1926, and was the first hermetically sealed unit on the market. Many thousands of the DR units are still in operation, their lives having far exceeded the life expectancy of refrigerators of that early vintage.

Fred Straub, assistant service manager of Rex Cole, Inc., G. E. distributorship in Metropolitan New York, plays the part of the service man in the movie which runs 25 minutes.

Showing of the film will be one feature of coast-to-coast refrigerator service training meetings to be staged soon in key cities by G. E. distributors.

WPB Used Motor Unit Lists 30,000 Motors

The Used Motor Unit was able to fill all but 87 of the 1,515 requests for used motors and generators received in March, its first full month of operation, the General Industrial Equipment Division of the War Production Board announced recently.

Established within the Electrical Equipment Branch in mid-February to assist in locating idle second-hand motors and generators, the Unit already has on hand a listing of from 30,000 to 35,000 pieces of idle equipment from which to fill requests. Though much idle equipment is still unlisted and the Unit is urging owners of such equipment to register it, requirements for general purpose standard types of second hand motors and generators can readily be filled.

March demands made through the Unit totaled 31,623 hp and came from industry at large and from 29 war agencies. In furnishing information about idle equipment, the Unit put prospective buyers in touch with owners of 3,302 items, aggregating 164,964 hp.

The idle motors and generators placed in active service through the efforts of the Idle Motor Unit represented a direct saving in materials and manpower, the Division pointed out. The manufacture of an equivalent amount of new equipment would have used 400 tons of critical materials and approximately 40,000 man hours. Moreover, production was speeded up, since the idle used motors and generators were supplied within a few days whereas it would have taken weeks or even months to obtain new ones.

Army-Navy Honors Hubbard Company

On April 27th, 1943, Hubbard and Company, Pittsburgh, was honored by the bestowal of two stars for their Army-Navy 'E' pennant in recognition of continued excellence of production of war materials. A two-hour ceremony was held at the plant at noon in order to eliminate unnecessary work stoppage, and lunch was served to 2,500 workers and their families.

Joseph V. Smith, executive vice president of Hubbard and Company, was master of ceremonies and the "two-star" Army-Navy 'E' pennant was accepted for the company by John W. Hubbard, chairman of the board. Joseph Sparbana, president of Hubbard Local 211, accepted the Army-Navy 'E' lapel pin in behalf of the mill employees.

Principal speakers were Rev. Dr. Francis A. Cox, Lieut. Commander E. W. McKinley (USN Ret.), Colonel Herbert D. Vogle, Major Wm. F. Schwerin, Wm. J. Hart, C. L. Peirce, Jr., and Edward O. Tabor, Esq.

The ceremony was also attended by eighteen guests of honor from the Armed Forces of the United States of America.

Ward-Leonard Receives Award

The Navy Board for Production Awards has notified Ward-Leonard Electric Company, Mount Vernon, N. Y., of the Army-Navy "E" award renewal for their continued volume production.

Time-Saving Features In Utility's Operation

The City Public Service Board, of San Antonio, Texas, has inaugurated two new features in their operations, both designed to aid in working out problems arising from present conditions.

The first of these is the establishment of a Priorities Division. In the production and distribution of natural gas and electric power, many materials are required that are closely rationed by the government. It is the business of this Division to acquaint itself with all the provisions of any rationed commodity. Then, all

Joseph V. Smith, executive vice-president of Hubbard and Company, was master of ceremonies at the presentation of two stars for the company's Army-Navy "E" pennant in recognition of continued excellence of production of war materials. Mr. Smith is shown at the speaker's stand. At the extreme right, above, is John W. Hubbard, chairman of the Board, who accepted the two-star pennant for Hubbard and Company.

WRITE YOUR OWN TICKET *for*

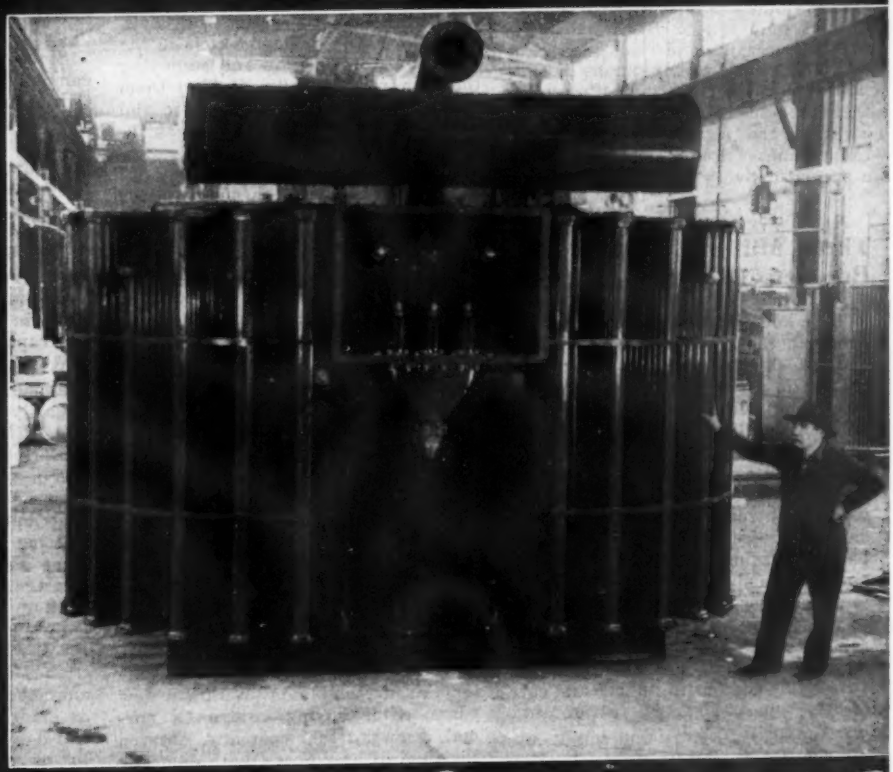
UPTEGRAFF TRANSFORMERS

TICKET

DELIVERY DATE _____

SPECIFICATIONS _____

Watch us make it— or Better it!



WE ARE MANNED AND EQUIPPED IN ENGINEERS AND SHOP TO GET YOUR TRANSFORMERS TO YOU "AS YOU WANT THEM, WHEN YOU WANT THEM." TELL US YOUR NEEDS.

R. E. UPTEGRAFF *Manufacturing Co.*

SCOTTDALE

PENN'A · U·S·A·

orders placed by the various departments of the Board which called for rationed merchandise, are sent to this Division. This Division determines if such merchandise is actually required, if a substitute can be used, and also determines when it may be purchased and delivery made.

This plan has proven a boon to department heads who have been harrassed in getting needed supplies. Now they only turn in their orders to the Division, assured that a competent authority will follow through and see that they get what is ordered. Sid Hall is in charge of the new division.

In the maintenance and upkeep of its thousands of domestic and commercial electric outlets, the Board maintains a fleet of trucks, and contact with the various units of this fleet is now maintained through a small, private radio station with two-way radio sets installed on each truck. Through this plan much time is saved.

As an illustration of what this service is doing, let it be assumed that a car has struck one of the poles in the eastern part of the city. The man in charge of the line crews looks over his schedule, determines which crew is nearest to the accident, and contacts that crew by radio.

The radio has also saved the time of crews on a job. If a line crew gets out on a job and finds that some particular piece of equipment or supplies are needed to finish the work, the foreman in charge immediately contacts the stores department by radio and the items are sent out by a special delivery truck.

Three Million Wartime Booklets Distributed

"The keen interest of people everywhere in the subject of conservation and the use and care of their refrigerators is shown by the demand for over 3,500,000 Wartime Suggestions booklets in 60 days," reports L. A. Clark, Frigidaire's advertising and sales planning manager.

The Wartime Suggestions booklet recently introduced as part of Frigidaire's service-type, advertising campaign, contains 36 pages of information designed to help people make their refrigerators serve them better and last longer. The booklet is not a conventional advertising piece, nor is it intended only for Frigidaire users. Instead, it deals with the use and care of any type mechanical refrigerator.

"Our dealers, large and small—appliance stores, public utility outlets, department and furniture stores—are all enthusiastic about this type program," Mr. Clark continued, "because during this period of limited sales activity on appliances, they see in it an unusual opportunity to build good will with present and potential customers."

To take advantage of this opportunity, Frigidaire dealers are providing refrigerator users with booklets in many resourceful ways. These include advertising the free offer through special window displays and interior store displays; and in the case of the larger outlets, through regular store advertising as well as special newspaper and radio messages. They are also placing booklets in the hands of store visitors and supplying them on service calls; mailing them to customers and giving them to and through employes to church organizations, lodges, study clubs, etc.

Some of the larger utilities are supplying booklets through meter readers and through nutrition classes and cooking schools coonducted through their Home Economics staffs. A number of department stores are making booklets available through standard information centers. As a result of these and many other methods of supplying booklets, Mr. Clark reports that exceptionally broad coverage is being secured.

Modern headquarters of McGregor's, Inc., Memphis, Tenn.

McGregor's, Inc., Develops Dehydrators

McGregor's, Inc., was organized in September, 1919, by John M. McGregor, its present president, doing business principally as an automotive supply firm, distributing such articles as Exide Batteries, Alemite Oils, Lubricants and Equipment, Carter Carburetors, etc. Within a few years, after having enjoyed a normal growth, the company entered the field of appliances, both domestic and commercial, and soon became the factory representative of such lines of products as: Frigidaire Home Appliances, Commercial Equipment and Air Conditioning Equipment; RCA Radios, Records, Parts and Sound Equipment; Coleman Gas Floor Furnaces and Oil Space Heaters; Easy Washers and Ironers, both gas and electric; Reed Attic Fans; Hunter Century House Fans; Koch Commercial Equipment; Magic Aire Vacuum Cleaners and numerous new automotive lines of equipment.

The company has enjoyed an increasing volume of business each year, reaching its peak of volume in 1941.

Since the outbreak of the war the company has engaged in various activities in connection with supplying equipment contributing to the war effort. Numerous installations have been made in Army Camps and Naval Bases, as well as in Air Training Fields, Government Hospitals, Ferry Commands and other Government Cantonments. Much war production processing work has been done and numerous installations have been made in war plants of various types and capacities.

When it became apparent that equipment such as the firm has customarily handled in volume would become difficult to obtain, reports Herbert Hobbs, vice president, a search was made of the market to determine what could be handled which would contribute most under the conditions existing today. The latest development the company has become interested in is the matter of dehydration of food. Two of the company's engineers, L. M. Barlow and F. L. Sanders, have been highly trained in the matter of dehydration engineering and have been selected as engineers on the largest commercial dehydrating and processing plant to be constructed in this part of the country. This plant will have a capacity of 40 tons of vegetables per day. In addition to this a great deal of study has been made in the field of home dehydration units.

(Continued on page 53)

Which comes first— Your second helping? or our second front?

YOU WANT TO SEE THIS WAR WON — and won quickly. You want to see it carried to the enemy with a vengeance. Okay—so do all of us. But just remember...

A second front takes food... food to feed our allies *in addition to* our own men.

Which do you want — more meat for you, or enough meat for them? An extra cup of coffee on your breakfast table, or a full tin cup of coffee for a fighting soldier?

Just remember that the meat you don't get— and the coffee and sugar that you don't get—are up at the front lines—fighting for you.

Would you have it otherwise?

Cheerfully co-operating with rationing is one way we can help to win this war. But there are scores of others. Many of them are described in a new free booklet called "You and the War," available from this magazine. Send for your copy today! Learn about the many opportunities for doing an important service to your country.

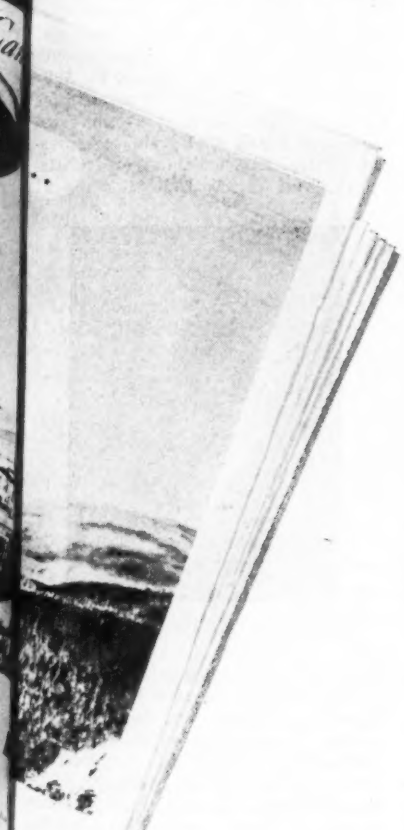
Read about the Citizens Defense Corps, organized as part of Local Defense Councils. Choose the job you're best at, and start doing it! You're *needed*—now!

Contributed by the Magazine Publishers of America

EVERY CIVILIAN A FIGHTER

This advertisement appears in the June 2 issues of the New York Herald-Tribune, Chicago News, St. Louis Post Dispatch, San Francisco Chronicle, Washington Times-Herald, Philadelphia Inquirer, Los Angeles Examiner, Dallas News, Boston Herald Traveler, Cleveland Press, Detroit News, Portland Oregonian, Buffalo News, Pittsburgh Press and in the June 19 issue of Business Week.

If General Cable can arouse public opinion to a fuller appreciation of the Electrical Industry's War-time Contribution to the national welfare, it will have realized its hope to have rendered a constructive service.



GENERAL CABLE

General Cable Corporation Sales Offices: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Kansas City (Mo.), Los Angeles, New York, Philadelphia, Pittsburgh, Rome (N.Y.), St. Louis, San Francisco, Seattle, Washington (D.C.)

PERSONAL NOTES
About Men You Know

Walter E. Poor, president of Sylvania Electric Products Incorporated, has announced the appointment of **F. J. Healy** to the position of vice-president in charge of operations, effective immediately.

F. J. Healy

Mr. Healy was formerly vice-president in charge of the lighting division. In his new post he will be responsible for all manufacturing operations in both the lighting and the radio tube divisions of the corporation.

Chester F. Horne, manager of operations at the fixture and appliance plants in Massachusetts, has been named general manager of the lighting division, replacing Mr. Healy. In this post Mr. Horne will be responsible for all manufacturing activities at the company's lamp, fixture, appliance and fluorescent powder plants in New England and Pennsylvania.

Both men have been connected with the company since its early days. In 1918, when the company occupied a single structure in Salem, Mass., and was known as the Hygrade Lamp Company, Mr. Healy was first employed as a floor boy. Two years later Mr. Horne joined the organization as an apprentice engineer. Both have been prominently identified with the development of the concern to its present position as one of the country's largest producers of radio tubes and of incandescent and fluorescent lamps.

* * *

On May 20, the Board of Directors of The Okonite Company, Passaic, N. J., elected **E. D. Youmans** vice-president and technical director. The following day Mr. Youmans was elected to the same position in Okonite's affiliate, The Okonite-Callender Cable Co., Inc., of Paterson, N. J.

Mr. Youmans, who was previously technical manager in charge of The Okonite Company's research laboratory at Passaic will have the responsibility of co-ordinating the entire research program of the two organizations including that of Okonite's Hazard Insulated Wire Works Division in Wilkes-Barre, Pa.

* * *

Ralph Z. Sorenson, of Chicago, has been appointed manager of the Table Appliance Department of the Westinghouse Electric Appliance Division, Mansfield, Ohio, succeeding **John A. Sullivan,** who resigned to become a lieutenant in the United States Naval Reserve. In making the announcement **T. J. Newcomb,** sales manager, said Mr. Sorenson's immediate duties will be in connection with the Westinghouse War Products Department.

Ralph Z. Sorenson

Mr. Sorenson joined the Westinghouse Electric and Manufacturing Company as supervisor of major accounts for the Northwestern District, with headquarters at Chicago. In January of 1941 he became appliance supervisor for the same district, handling the sale of heating appliances, fans and vacuum cleaners in ten Midwestern states.

* * *

The Silex Company, of Hartford, Connecticut, manufacturers of glass coffee makers, announces the appointment of **Harry J. Dillon** as district manager, with headquarters in Cincinnati. Mr. Dillon's territory will comprise southwest Ohio, Indiana, and Kentucky. Harry Dillon is a native Cincinnatian, and was formerly with the Toastmaster Products Division of the McGraw Electric Co.

The Okonite Company, manufacturers of electrical insulated wires and cables, with executive offices in Pasaic, N. J., has established a sales office at 904 Pere Marquette Building, New Orleans, La. The office is in charge of **W. D. Stroud,** sales engineer. The territory of the new sales office will include Louisiana, Southern Mississippi, and Northwest Florida.

* * *

Charles A. Conklin has been appointed manager of the Westinghouse Lamp Division's Central District, with headquarters in Pittsburgh, Pa., and **Robert A. Corvey** has been named manager of the Southeastern District, with headquarters in Atlanta, Ga. Mr. Corvey, formerly Northeastern District assistant manager, succeeds Mr. Conklin at Atlanta. The appointments were announced by **Bernard H. Sullivan,** Lamp Division general sales manager, who disclosed at the same time that **Frank C. Barrington,** present Central District manager at Pittsburgh, will retire June 1 after 31

R. A. Corvey

years with the company.

Mr. Corvey, the new Southeastern District manager, was born in Worcester, Mass., and attended Brown University. He came to Westinghouse in 1923 as the Albany, N. Y. sales representative for the Lamp Company, later serving in a similar capacity in Binghamton, N. Y.

He was appointed manager of the Boston office and later the Philadelphia office where he remained until his appointment as assistant manager of the Northeastern District with headquarters in New York City. Mr. Corvey is a member of the Illuminating Engineering Society.

* * *

D. D. Murphree, division engineer for Southwestern Gas & Electric Co. at Shreveport, La., died at Schumpert sanitarium in Shreveport at 3 a.m. May 4, following an illness of several months.

Mr. Murphree was born and reared in Thomastown, Texas, where he attended the public schools. He later

D. D. Murphree

attended Texas A. & M. and was graduated in 1921 with a B.S. degree in electrical engineering. After graduating, he became associated with the Southwestern Bell Telephone & Telegraph Co. as a student engineer in San Antonio. In the latter part of 1922, he went into the electrical contracting business in Austin, Texas, as a member of the John L. Martin electrical contracting firm.

In March of 1926, he was employed by the United Gas Improvement Co., as distribution engineer for the Galveston Electric Co. in Galveston. In 1929 he went to San Antonio, where he was employed in the commercial department of the Central Power & Light Co., doing rate analysis work. He was later transferred to their engineering department, where he remained until 1932 when he was granted a leave of absence.

In 1933 he went to the San Antonio Public Service Co.'s commercial department in the merchandising division. He left this position in 1935 and attended the University of Texas, where he did work on his master's degree in electrical engineering.

In June, 1936, Mr. Murphree came to Shreveport as distribution engineer which position he held until July, 1941, when he was promoted to the position held at the time of his death.

Mr. Murphree was a member of the AIEE, the IAEI, the Electric League of Shreveport, and the Petroleum Engineer's Club.

He was married in 1921 to Miss Leona Nagel of Cuero, Texas.

* * *

Alfred L. Eustice, president of the Economy Fuse and Manufacturing Company, of Chicago, died suddenly of a heart attack on April 30 at his home. He was 58 years old and was reared in Galena.

Mr. Eustice was noted for his invention and development of a renewable link-type electric fuse, and had been selected as a member of the "Modern Pioneers" by the National Association of Manufacturers.

ON PUSH OFF

HOT ARCS STOPPED COLD!

BullDog's Vacu-Break Safety Switch with "Clampmatic" Contacts provides the faster, tighter closing — and quicker, smoother opening — needed for safest, most dependable operation at lowest maintenance cost.

ON "Clampmatic" switch contacts exert a wedging action when engaged with the beveled ends of the stationary contact prongs. This wedging action puts great pressure on the movable slug, for positive pressure contact in ON position.

OFF When the handle is pushed to OFF position, the static energy stored in clamp spring helps make an easier, smoother separation of contacts. This quick-break operation in the close-fitting arc chamber creates a MAGNETIC BLOW-OUT effect which quickly dissipates arcing.

Streamlined, push type, front-operated rocker handle inside cabinet lines.

BULLDOG Vacu-Break SAFETY SWITCH

with "Clampmatic" Contacts and front-operated Rocker Handle.

Movement to OFF is speeded by release of static energy in clamping spring.

Formed bakelite cover (arcing chamber) removed from switch head to show action.

Instant, positive pressure contact caused by wedging action of moving contact when operating to ON position.

Full ON position. Moving contact now fits tightly between stationary Line and Load contacts under full clamping pressure of the spring.

BULLDOG
ELECTRIC PRODUCTS CO.
Detroit, Michigan

BullDog Electric Products of Canada, Ltd., Toronto, Ontario

Field Engineering Offices in All Principal Cities

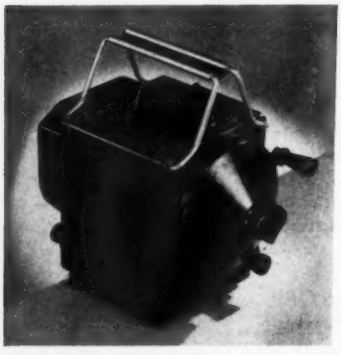
MANUFACTURERS OF Vacu-Break Safety Switches, SafToFuse Panelboards, Circuit Master Breakers, Switchboards, Bus Duct Systems— FOR LIGHT AND POWER.

BUY MORE WAR BONDS

NEW EQUIPMENT and MATERIALS

Insulation Tester

Handsome, rugged molded plastic cases, fabricated from Bakelite impact-resistant phenolics, are attractive, protective features of James G. Biddle Company's new "Megger" Insulation Testers—first U. S.-made models of the well-known "Megger" testing instrument line.



Other outstanding advantages claimed are: no batterieis or other outside source of current needed; no keys to press, no dials to adjust; insulation resistance indicated directly by pointer deflection, same as voltmeters indicate volts; accuracy independent of generator cranking speed; strong, compact, integral construction; all joints dustproof. The instrument housings and individual parts—five for one model and six for the other—are molded by the Chicago Molded Products Corporation.

New G-E Lamp Starter

A milestone in the development of fluorescent lamp accessories was reached here during May when for the first time an average rated life of three years was announced for a fluorescent lamp starter by General Electric Company's Appliance & Merchandise Department.

First starter to carry the 3-year rating is called the "Watch Dog". It is a manual-reset type for 40-watt lamps. Its catalog number is FS-40. G. E. literature describing the "Watch Dog", states that it has "an average rated lift of three years under specified test conditions".

The mechanical features which prolong the life of the "Watch Dog" starter also help to conserve the life of the lamp, life of the ballast, power consumption and maintenance service. These mechanical features are as follows:

1. Precision lamp starting. The "Watch Dog" is timed to light the lamp at the right instant. This conserves emissive material essential to long lamp life. It also prolongs the life of the starter.

2. Dead lamp lockout. Close tolerances in the starter's mechanism make possible a quick and positive performance in the lockout of dead lamps, eliminating blinking and flickering when a lamp burns out. This feature has several advantages: (a) it prolongs the life of both starter and ballast, since flickering is hard on both; (b) practically no current flows through after the dead lamp is locked out; therefore the current which would have been used if the lamp continued to flicker, is conserved; (c) maintenance time is saved because no cooling or waiting period is required before removing dead lamps; they can be removed immediately.

When a dead lamp is removed, the "Watch Dog" is reset simply by pressing a button on top of the starter. The new lamp is then inserted, and the "Watch Dog" brings it into the circuit immediately. The "Watch Dog" is painted gray and has white lettering for easy identification.

Rechargeable Flashlight Cell

The limitation of flashlight dry cell production has focused attention on the Ideal Rechargeable Storage Battery for flashlights. This type of cell was introduced about three years ago for industrial and utility service and is now fast proving its value wherever flashlights are required in regular use.

Although small in size to fit all popular two cell, 1-1/4" size D Flashlight Cases, it is proven through actual heavy duty service to be dependable, long-lived and economical. According to the manufacturer, the Ideal Commutator Dresser Company, Sycamore, Illinois, each battery can replace up to 400 or more dry cells. This is possible by merely recharging at convenient periods. Battery chargers are available for this purpose, both in single and gang types—for use on both alternating current and direct curent.

The Ideal battery is not generally distributed for casual use, but under present conditions is directed to large industrials, utility plants and other sources where flashlights are used regularly. Under these conditions, a large savings can be effected for in heavy use, one discharge is approximately equal to a pair of ordinary dry cells.

Marine Lighting Panels

Square D Company's Switch & Panel Division, Detroit, Michigan, has announced a complete line of Marine Lighting Panelboards and Marine Power Distribution Panelboards, designed to meet Government requirements.

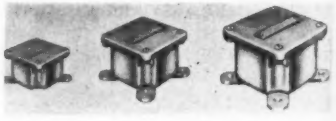
The lighting panelboard has drip proof top and is built to meet Naval shock-resisting specifications. Branch circuits have 30 ampere, 250 Volt, heavy duty tumbler switches, available in 1, 2 or 3 pole or combinations. Mains can be either 2 or 3 wire, 125/250 Volts A.C. - D.C.

One feature which has made the Square D line of panelboards popular with naval and marine architects and electrical engineers of shipbuilding companies is the patented Square D Positive Pressure Fuse Clips. So effective is the gripping of the fuse ferrules that fuse-retaining blocks are not required, yet the fuses may be replaced quickly and easily.

Square D Marine Panelboards are described in the free bulletin No. 3100—recently released.

Spero Marine Fittings

The Spero Electric Corporation, Cleveland, Ohio, announces that it has added to its line of electrical products a complete line of 9S Series of Metal Enclosures and Accessories manufactured in accordance with Navy Specifications.



Since steel stampings have replaced cast bronze and aluminum for switch boxes, branch boxes, junction boxes, etc., in navy and marine construction, there has been an unprecedented demand for these fittings. Normally engaged in the manufacture of commercial and industrial electric installation equipment and lighting fixtures, the Spero plant is ideally set up to produce large quantities of 9S units. Informative literature describing the line is being prepared and will soon be available.

Illustration shows basic 9S Navy boxes available in 3", 4" and 5" sizes, watertight or non-watertight, with the following devices: double pole switches, three pole switches, two-circuit switches, three-way switches, plug Receptacles, push Buttons, branch Boxes, and junction Boxes.

Book on Use of Wood

A new illustrated book for priority-hounded executives and engineers—"Wood and Its Place in the War Effort"—is available without charge to companies engaged in war work. Published in limited edition. Write to Kay Displays, Inc., 9 East 40th Street, New York, N. Y.

Maintenance Bulletins

"Victory Production and Maintenance News," previously issued as "Victory News" by Allis-Chalmers, Milwaukee, Wisconsin, will hereafter endeavor to help industry find out how to keep its production machines running through the rest of the war, the company announces with the release of the new issue.

Inviting an exchange of maintenance ideas from equipment operators, the publication carries these in addition to tips from Allis-Chalmers engineers on the proper maintenance of the hundreds of products manufactured by this company. Emphasis on the value to the war effort of intensifying maintenance is supplemented by production stories in news and pictures, pointing out new ways to increase war production. A handy index lists maintenance articles appearing currently in the leading trade papers.

Maintenance men and executives interested in stepping up maintenance to meet wartime needs in their plants can get this publication regularly by writing the Allis-Chalmers Mfg. Co., Milwaukee, Wisconsin.

Knob and Tube Wiring Chart

Chart for knob and tube wiring, revised to meet 1940 National Electrical Code and revisions, has been printed and is now ready for distribution, as an aid to all electrical contractors and workers.

The chart was originally developed in 1935 and approximately 155,000 copies have been in use. Since the Code revisions of 1940, the publisher claims many requests were made for a revised chart to meet the latest requirements.

This chart is of particular value at this time due to the action of the War Production Board in stopping or materially curtailing the manufacture and use of wiring systems using critical materials. This chart illustrates how porcelain and other non-critical materials may be used.

Other facts, prices, etc., may be obtained by writing James Steel Mahan, 201 North Wells Street, Chicago, Illinois.

New Boric Acid Fuse

For outdoor power systems a new weather-protected intermediate duty boric acid fuse which interrupts the circuit to the faulted equipment, and isolates the fault from the feeders with a complete 180 degree air break is announced by Westinghouse Electric and Manufacturing Company.

In the new DBA-1 fuse, the blown fuse unit is dropped out of the circuit after the fault current is interrupted. Thus there is no possibility of burning contacts or arcing between fuse tube and clips, or of any carbonized fuse parts breaking down to produce leakage or a second fault. Other features are the "de-ion" boric acid arc quenching action and the sleetproof ejector mechanism for allweather operation.

The DBA-1 fuse is available in voltage ratings from 7.5 kv through 69 kv. It is applicable in utility and industrial high-voltage power systems for protecting power transformers, high voltage capacitors, and potential transformers.

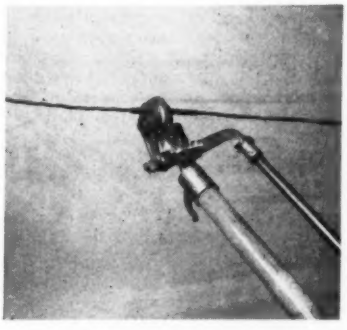
Heavy Duty Strain Connectors

This cable strain connector meets the need for this type of equipment on defense projects where multiple cables are being substituted for copper tubing or rolled sections in an effort to conserve copper.

Illustration shows type "SUD" strain connector to take two 1,000,000 CM cables in parallel. Fittings are available for multiples of two or four cables in all cable sizes up to 1,000,000 CM. Multiple cable fittings are listed in Publication No. 4211, available upon request to Delta-Star Electric Company, Chicago, Ill.

Hot Splice Tool

It is now possible to apply the Nico-Press type sleeve splice while the lines are hot by using the Universal Splice Tool and this new Nico-Press crimping device developed by the A. B. Chance Company, of Centralia, Mo. This feat is performed by pulling the loose ends to be spliced taut with blocks insulated with link sticks and applying the funnel-like splice tool, mounted on a Universal pole, to the splice sleeve.



While this is held in position, the loose end of one conductor is guided with a Grip-All Stick through the funnel and into the splice. Holding the conductor in this position, the Nico-Press crimping tool or splice tool is applied to the sleeve crimping it to hold the conductor in the splice. The Universal Splice Tool, or funnel, is then removed and fitted to the other end of the splice where the same operation completes the job.

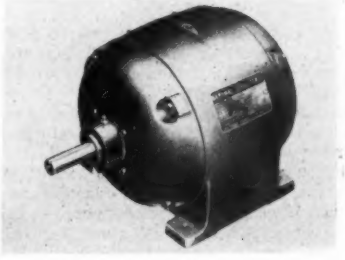
Curtis Inspection Light

A new Curtis dust-tight inspection lamp is essentially a magnifying light for two 6-watt fluorescent lens with auxiliary lighting. It was designed for and is being used in ordnance plants where open-type units were not acceptable. The unit consists of a steel housing 12-5/8" in diameter and 2" deep, and is furnished with a white Fluracite reflecting surface inside. All outside surfaces are finished in crackled gray.

The magnifying lens is of the double convex type, 4-1/32" diameter. The shatter-proof cover glass is lightly sanded for diffusion except for a clear spot 3-3/4" diameter directly under the lens. The swivel base and movable arm permit adjustment of the unit over the inspection plane for correct focusing of the objects to be inspected. A cylindrical shield to reduce reflections on the upper surfaces of the lens is available as an accessory. For further details write to Curtis Lighting, Inc., Chicago, Illinois.

G-E Enclosed Motors

A new line of totally enclosed motors, the most recent addition to the widely known group of Tri-Clad motors, has been announced by the Motor Division of the General Electric Company. Available in both the polyphase, 60-cycle, induction type and the single-phase, 60-cycle, capacitor type, the new motors are especially designed for use under conditions where abrasives, chemicals, rain, snow, and excessive dirt are encountered.



The polyphase motors are furnished in frame sizes 203 to 225. They include ½, ¾, and 1 hp at 900 rpm; ¾, 1, and 1½ hp at 1200 rpm; 1, 1½, and 2 hp at 1800 rpm; and 1½ and 2 hp at 3600 rpm. The single-phase motors are furnished in frame sizes 203 and 204, and include ¾ hp at 1200 rpm; 1 and 1½ hp at 1800 rpm; and 1½ and 2 hp at 3600 rpm. The mounting dimensions of these motors are interchangeable with Tri-Clad open motors of the same rating.

These new motors have all the important basic features of the Tri-Clad group. This includes triple protection—protection against physical damage, electrical breakdown, and against normal operating wear and tear.

Glow-type Fluorescent Starter

To augment its line of fluorescent lamp starters, Sylvania Electric Products, Inc. of Salem, Mass., has introduced a glow-type starter, designated as "Glostat". The construction of this starter allows it to take severe punishment from a failed lamp, and it will show long life in service. It is available in two sizes: the FS-2 for use with 15- and 20-watt lamps, and the FS-4 for use with 30- and 40-watt lamps.

The Sylvania "Mirastat", a thermally operated starter which has well earned its reputation for reliable operation, is continued in the line. In addition to an exclusive timing device, the "Mirastat" has a restarting position that adds extra life to the starter. It is available in four sizes: M-2, for use with 10- and 20-watt lamps; M-4, for use with 30- and 40-watt lamps; M-6, for use with 100-watt lamp; and M-7, for use with 65-watt lamp.

Day-Brite Fixtures

A new series of War Model Day-Line fluorescent industrial fixtures has been announced by Day-Brite Lighting, Inc. of St. Louis. These fixtures are designed in compliance with the latest WPB steel limitation order governing the amount of steel that can be used in equipment of this type. The wiring channel and end boxes which incorporate the socket saddles are of steel securely

welded together to assure correct lamp spacing and sturdy construction. Non-metallic reflectors and channel covers are finished in baked enamel. Controlled manufacturing conditions and constant checking have provided one of the best finished reflectors on the market today. These reflectors are held in place by two wing-type latches that are permanently attached to the reflector and do not require tools for operation.

Ballasts are mounted below the channel providing better air circulation for cooler operation and longer life. Lamp starters are located behind the sockets and are replaceable without disturbing the lamps. Bulletin F-67 will be mailed upon request.

New "Mitchelite" Catalog

To introduce their new all-purpose Mitchelite line of fluorescent fixtures for war industry, the Mitchell Manufacturing Company, of Chicago, have published a complete, comprehensive 8-page 2-color catalog.

This new Catalog No. 400 illustrates and explains all the new Mitchelite features—shows how they meet the latest requirements of WPB and U. S. Bureau of Standards—how they make Mitchelite fluorescent lighting easier and more economical to install and maintain.

The Catalog gives details and prices on all four new Mitchelite models—Model No. 2075 for 2-40 watt lamps; Model No. 2076 for 3-40 watt lamps; Model No. 2077 for 2-100 watt lamps; and Model No. 2078 for 4-100 watt lamps (a 2-section unit operating with only one "Forlamp" ballast). And it shows how each Mitchelite model can be used for both individual and continuous row lighting, for surface or suspension mounting.

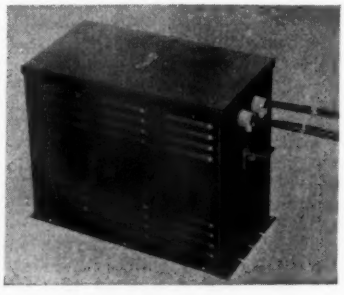
New Voltage Stabilizer

General Electric has announced a new voltage stabilizer which provides a constant ouput of 115 volts from circuits varying between 95 and 130 volts.

This stabilizer is insensitive to load power factor. It is not affected by variations in load from no load to full load or by changes in power factor from unity to 0.8 lagging. It is completely self-protecting, and will operate continuously throughout the range from open circuit to short circuit without damage.

The new stabilizer can be applied wherever close voltage regulation is requisite to good operation — in radio transmitters, electronic-tube apparatus, motion-picture sound equipment and projectors, telephone apparatus, X-ray machines, photocell equipment, and in the calibration of meters, instruments and relays. Ratings from 50 va to 5000 va are available.

Publication GEA-3634 describes the new voltage stabilizer in detail.



New Three-Lamp Ballast

The development of a 3-lamp, 40-watt, high-power-factor ballast for fluorescent lighting of war plants has been announced by the General Electric Company, Schenectady, N. Y.

Formerly, a 3-lamp fixture—which employs three 40-watt Mazda F lamps set side by side—required two ballasts, one Tulamp 40-watt and one single-lamp, high-power-factor 40-watt. The new 3-lamp ballast is better adapted to installation in a fixture than two separate ballasts, and the use of one ballast instead of two simplifies installation and reduces the amount of wiring required for connections.

The new ballasts are designed to operate on lighting circuits of 110-125, 199-216, 220-250, and 240-280 volts. Power factor is 90 per cent or above. Supplement No. 3 to GEA-3293D describes the new ballast in detail.

Fibre Pipe and Conduit

The resourcefulness of American industry in developing new applications of non-critical materials is illustrated by announcement of a new line of non-metallic drain and sewer pipe by The Fibre Conduit Company, of Orangeburg, N. Y. The company has manufactured conduits for underground cable protection since 1893 and underfloor electrical ducts since 1923. Tests have shown that these same conduits in larger sizes satisfactorily replace metal pipe for many industrial, building material and farm uses.

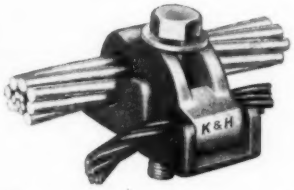
According to H. J. Robertson, Jr., prsident of The Fibre Conduit Company, the new Orangeburg non-metallic pipe is resistant to moisture, tuberculation, corrosion and most dilute inorganic acids and alkalies. Extremely durable, light and easy to handle, it can be installed by almost anyone and can be cut to desired lengths with an ordinary wood-working saw.

Two types are available—perforated and non-perforated. The perforated pipe is designed especially for ceptic tank filter beds and foundation footing and field drainage. A distinct advantage of the perforated pipe is that it repels root growth.

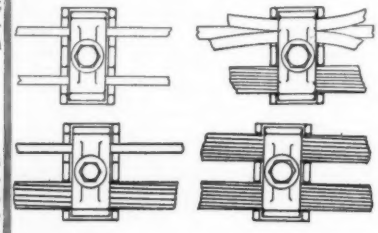
Already, oil companies in Texas, Oklahoma and other fields have installed over a million feet of this pipe in connection with salt water disposal. And in a bulletin dated January 11, 1943, the State of Wisconsin Board of Health recommended the use of Orangeburg non-metallic pipe to replace the rapidly diminishing supply of reclaimed pipe for shallow water well construction.

Universal Tap Connector

A connector offering a wide range of application and suitable especially for guy wire ground, or transformer and lightning arrester connection to ACSR or Copperweld conductors where the diameters may be from 8-A Copperweld to .595" ACSR Armour rods, has been introduced by Krueger & Hudepohl, of Cincinnati, Ohio.



The connector is available in three different finishes: (a) cadmium plated all over for connecting aluminum conductor to steel guy line or to another aluminum conductor; (b) one-half cadmium plated for connecting copper to steel or copper to aluminum; and (c) unplated surface for connecting copper to copper.



The connectors are constructed of 85% copper alloy and are designed to permit insertion of largest size conductors without removing any parts of the connector.

Self-Contained Dust Collector

A new, low cost, portable Dustkop dust collector, especially built for operation on 25 or 60-cycle alternating current, but otherwise employing the same design and construction characteristics as the standard Model 600 Dustkop, is added to its line of portable, industrial dust collectors by Aget-Detroit Company, 2040 Book Bldg., Detroit, Michigan.

The new model has a rated volume of 600 cfm and 4.1 inches static pressure, making it suitable for collecting the dust and dirt from tool, cutter, precision and similar grinding operations. In order to maintain the air velocity at about 600 fpm for the greatest efficiency on such grinding operations, the fan must be driven at about 3450 rpm. Since this is not practical with standard motors built for lower frequencies when driving direct, an over-drive countershaft is employed. The fan is mounted on the shaft and the motor drives it through a "V" belt drive for the proper fan speed.

Being portable and self-contained, the new DUSTKOP eliminates entirely the necessity for costly duct work

RE-LIGHTING
the new manpower production *requirement*

HERE'S ONE ANSWER
to this problem...

This new folder tells the whole story. Send for it!

Because most plants operating today were designed for peacetime, *daylight* working schedules, *their lighting equipment is inadequate for night work!*

The folder illustrated gives one answer to industry's problem of *re-lighting*. Silv-A-King's new fluorescent reflectors of non-critical, metal-saving Silv-A-Tex are durable, efficient, inexpensive, and available for prompt delivery. For complete descriptions and specifications of Silv-A-King "Victory" units, write for a copy of "Catalog 43-V" today!

UL SILV-A-KING RLM

SILV-A-KING
MAKES *Light* WORK FOR YOU

BRIGHT LIGHT REFLECTOR COMPANY, INC.
310 Morgan Avenue, Brooklyn, N. Y.

BROILKING AFTER THE WAR, MORE THAN EVER *America's Finest Electric Table Broiler*
INTERNATIONAL APPLIANCE CORPORATION
1027 Metropolitan Avenue, Brooklyn, N. Y.

"National SN"

BUS DROP CABLE

Designed for branch circuit runs from the plug-in devices on busway systems, wireways and other raceways to machine tools and other similar applications.

1. Saves rubber. Insulation and jacket made entirely of "National SN" thermo-plastic material.

2. Eliminates steel. No conduit required for branch circuit from the bus plug-in device or feeder raceway to the machine.

3. Eliminates special fittings. Standard National Electric EZ Armored Cable Connectors used as box connections.

4. Fire-resistant. "National SN" thermo-plastic material will not burn.

5. Highly resistant to oils, acids, alkalis, moisture, cutting and cooling fluids, and mechanical abuse. "National SN" Bus-Drop Cable renders maximum serviceability at minimum cost per machine.

National Electric
PRODUCTS CORPORATION
Pittsburgh, Pa.

installation and is not to be connected into centralized system. Available with either one or two inlets as required, the latter make a slip fit with standard outlets of the grinder, or into separate sheet metal intake hoods.

Universal Multitester

The new R.C.P. Model 419 Multitester combines in one instrument, a-c and d-c, voltmeter, millimeter, ammeter, capacitymeter, ohmmeter and inductance meter, thus making this unit ideally suited for a wide range of shop, laboratory and field applications.

The Model 419 incorporates in its design the new R.C.P. system of a-c measurements, eliminating the copper oxide rectifier. A-c scales are linear with d-c scales. Sensitivity of meter is 2,000 ohms per volt—accurate to within 2 per cent. Capacitymeter is direct reading with widespread scales. Ohmmeter has self-contained power supply. Sensitivity of low ohm range makes it excellent for checking shorts, measuring of contact resistance, resistance of voice coils, etc. Meter is fused and supply line double fused.

Further information can be obtained upon application to the manufacturer: Radio City Products Co., Inc., 127 West 26th Street, New York City.

Reco Heat Circulator

The new Reco Heat Circulator meets with present wartime needs because it keeps rooms comfortably warm with much less fuel. The war program demands that everyone reduce the fuel consumption to the minimum.

The Reco principle of operation is a simple one but one that promises to revolutionize present heating practices. It blows free air up at high velocity. The air then travels along the ceiling, down the walls and back up the center again, with decreased velocity and increasing volume.

This action forces the hot, moi air which always accumulates at t ceiling down, resulting in unifor temperature and humidity throughou the room.

Its operation makes rooms co fortable which because of layout a difficult to keep warm. It provide quick heat for large, high roo which are normally hard to heat. eliminates cold floors. It provide re-vitalized air for rooms that g stuffy with smoke, odors or stale a

Readers are invited to write t Reynolds Electric Company, 2650 W Congress St., Chicago, Ill., for fre literature.

Cable Terminators

A new Publication No. 4303, gi ing data on "PB" indoor cable te minators for voltages up to and i cluding 2300 has been issued Delta-Star Electric Company, Chic go, Illinois. This is a low cost cab end sealing device with either m chanical, stuffing box or wipin sleeve entrance. Construction an dimension details are given. Copie are available on request.

Fixture Extension Arms

To eliminate the constant rubbin of lamp cords against reflector shades and bowls, and causing need less wear, expense and hazard swaying and broken fixtures, th engineers of McGill Manufacturin Company, Inc., Valparaiso, Indian have developed the new Levolier E tension Arm shown here.

This unit is designed to fit ove the Levolier switch lever. The Nos 86 and 86-L arms are made to fit o the new steel lever 41-B, 1010 an 1039 Plastic Shell Switches. The pul cord is threaded through the end hol or the loop of the extension arm an attached to the chain on the lever This affords a means of pulling ligh on and off without interference fro the shade or basin fixture.

McGregor's, Inc., Develops Dehydrators

(Continued from page 42)

The company has built a number of domestic dehydrating units, improving each from experiences gained in the operation of preceding units, and hopes shortly to be able to produce and put on the market a home dehydrating unit at a very moderate price. Obviously, the company has run into the difficulty of obtaining certain materials which are critical and which are desirable over certain other materials in the construction of the proper type of unit. If priority requirements can not be met, it is felt that a few adequate substitutions can be made without impairing the performance of the unit or affecting its operation.

McGregor's, Inc., is confident that its dealer organization will be held together during the emergency period and will be available and ready to function in the post-war period even to a greater degree than before the war. A great deal of stress is placed on the absolute necessity of Frigidaire dealers maintaining adequate and prompt service on all the equipment installed in the various territories, realizing that since no more equipment can normally be purchased the old equipment must be kept in operation.

This policy will materially strengthen the dealer organization and insure better trained men for servicing the equipment during the post-war period. To further this plan, the company holds service schools periodically for the purpose of furnishing further training for the dealers and service men in the matter of rendering service. A series of such schools were held during the month of April.

Reconnecting Motors For New Voltages

(Continued from page 29)

Suppose we have a three-phase, six-pole 2,300-volt motor that is connected two-parallel-Y and we want to reconnect it for 440 volts. Then 440/2300 equals .1913. Consulting Table I and the "2-Parallel-Y" horizontal line, we find the factor .192 under "6-Parallel-D". Then if we connect the motor six-parallel delta it would require a line voltage of 2,300 x .193 or 443.9 volts, which is 3.9 volts over but is satisfactory.

In another case, assume that we have a 110-volt, three-phase, twelve-pole, six-parallel delta connected motor and want to reconnect it for 550 volts. Then the factor required is 550/110 equals 5.0. Looking in Table I on the "6-Parallel-D" line, we find the factor 5.19 under "2-Parallel-Y." Accordingly, if we

Federal Rolarc SAFETY FACTORS

INCREASE PRODUCTION

When a switch fails machines stop—vital war production slows down. And one of the reasons for switch failure is uncontrolled arcing. That's why the Federal 575 Volt Rolarc Safety Switch* is built with special safety features to control and reduce arcing to an *absolute minimum*—and so to increase production by eliminating delays and accidents caused by switch failure.

Two parallel cylindrical rollers fabricated from high arc-resistant material form an insulating barrier to "dam up" and snuff the arc. This gives the Rolarc many added advantages that increase switch safety and service through perfect control of arcing.

Follow the leaders—for extra service and safety switch to Federal.

*100-600 Amperes only.

For Complete Rolarc Data

write for Bulletin 42-12. Contains all the essential facts on the Federal 575 Volt Rolarc Safety Switch.

SOUTHEASTERN REPRESENTATIVE
Fulwiler and Chapman
314 Luckie St., N. W.—Atlanta, Ga.—Jackson 2146

FEDERAL ELECTRIC PRODUCTS COMPANY
60 PARIS STREET NEWARK, N. J.

PANELBOARDS • SWITCHBOARDS • SAFETY SWITCHES • CIRCUIT BREAKERS

reconnect this motor for two-parallel-Y, the line voltage will have to be 110 x 5.2 equals 572 volts, or 22 volts over 550, which is satisfactory, as standard motors are listed to operate on 10 per cent over or under voltage.

It can be seen that the table will be of considerable help in solving many reconnection problems. The connecting diagrams published in preceeding issues of ELECTRICAL SOUTH can be used with Table I.

To illustrate how changing the type of connection can be done in some cases to speed up a rewinding job, it may be well to mention a recent case. We had a 96-slot, three-phase stator connected two-parallel-Y. This was to be rewound to perform the same duties as before. There were ninety-six coils, diamond-pulled, of fourteen turns of one No. 13 square wire. The wires in the coil were laid two wide by seven deep which is called a "cross-over" coil. Each cross-over had to be taped which meant that each coil would require considerable time to make. But it was found that this cross-over could be eliminated by using a plain coil and changing the motor connections. Accordingly, the coils were made up of seven turns of two No. 13 square wires in parallel (2 by 7) thus cutting the turns per coil in half and eliminating the cross-over. This type of coil can be wound in one-third the time required for a cross-over coil. Changing the turns to one-half also increased the cross section of copper 100 per cent and this would indicate that the motor should be operated on half the original voltage. However, the connections were changed from two-parallel-Y to series-Y enabling the motor to run on original voltage.

It is combined changes like this one that enable a great deal of time to be saved in repair work. Furthermore, the time saved is not the only benefit derived from eliminating a cross-over coil. Another important feature is that with the average help in most repair shops there is more chance for short circuits in cross-over coils. The reason for this is illustrated in Fig. 1. At A are shown the first three turns wound correctly in place. The first turn is at the left, the second on the right, and the third is on top of the second. It is at this point that trouble starts, as the third turn has a tendency to slip down into the space formed on top of the two round wires, as in drawing B. When the fourth turn is laid in and an attempt made to flatten out the second layer by pounding with a fiber drift and mallet, there is not enough space between the third turn and the side of the shuttle for the fourth turn.

Pounding tends to crush the cotton covering on wires 3 and 4. If they are pounded hard enough the insulation will be cut and a dead short will result. Unless each coil is carefully inspected, this defect will not be noticed until the stator is wound and given a balance and run test which means time lost in removing the faulty coils. The term "cross-over" means that the wire is crossed up from the end of one layer to the start of the next layer.

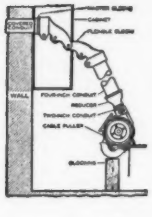
A further discussion of rewinding and reconnecting a-c motors will appear in the next issue of ELECTRICAL SOUTH.

YOU CAN DO THE JOB EASIER AND FASTER WITH A GREENLEE CABLE PULLER

● Here's a fast, easy way to pull cable that does away with cumbersome equipment and make-shift methods. There's no wear and tear on conduit hangers . . . the tool is portable . . . pays for itself on first few jobs.

PULLING FROM EXPOSED CONDUIT

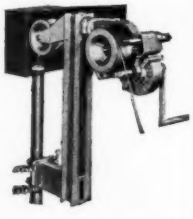
As shown at left, Puller clamps directly on conduit which serves as a positive anchorage. *Its unique design eliminates loosening conduit hangers by applying a holding force to the conduit itself — a force equal to the outward pull on the cable.* For clearance in close quarters, the adjustable tension drum can be swivelled around in full circle. Puller has two-speed gearing — maximum pull 7500 pounds.



PULLING FROM CONCEALED CONDUIT

For concealed work a flexible elbow attachment is used. A fitting is connected to conduit, and the removable tension drum is attached to a suitable length of 4" conduit which serves as a connector to the elbow joints.

PULLING INTO JUNCTION BOX



Here the Puller is set up for pulling into a junction box from a vertical conduit. In this photo, tension drum is swivelled around from position shown in the top picture. Special conduit adaptors are supplied for close quarters.

GREENLEE TOOL CO.
1766 COLUMBIA AVE.
ROCKFORD, ILL.

WRITE FOR FREE COPY CATALOG 33E
Get complete details on Cable Puller and other Greenlee tools for the Electrician that help speed up work . . . write for Catalog 33E.

Improving Efficiency Of a Motor Shop

(*Continued from page 27*)

machine which has proved to be such an efficient contribution to the smoothness of the flow of work.

Essentially, the new motor washing equipment is a large steel box in the center of which is a steel turn-table or platform on which the parts to be washed may be turned about. The workmen doing the washing revolves the parts by hand, merely turning them around in order to play the hose on them from all angles.

The steel tank is oil tight and has a drain in one corner where the washing fluid drains back into the main tank. Mineral spirits is used for this cleaning. The fluid is circulated by a small centrifugal pump, and a mixing valve is used to add compressed air from the regular shop source for pressure.

This speeded up the washing of the motors tremendously and made it possible to do a better job. We used the solvent over and over again.

A track for a set of falls or

hain hoist runs from the main floor of the shop to the washer, making it a matter of minutes to place a large motor part on the turntable. Mr. Turner said that all of these changes, made necessary by the war, had promoted efficiency in the plant.

In the matter of credits, he said that they were much more strict now on credit than ever before. They installed complete credit files and check on every customer.

"We can't afford to waste our manpower and our strategic materials on a customer who can't pay his bills on time," Mr. Turner said. "If we find their credit slipping, we put them on a C. O. D. basis. You can't have your volume going up every day, your inventory going down, and then bother with credit losses. You've got to have your money to use for the increased business.

WPB Plan Promotes Efficiency

Mr. Turner said the War Production Board allotment plan had a tendency to reduce purchases and this in turn promotes efficiency throughout the plant.

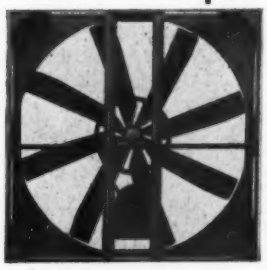
"Now," Mr. Turner said, "we analyze our shop requirements before we make any purchases. We are allowed to buy a certain amount of shop tools and supplies. We estimate these in advance before purchase whereas before the war if we needed one file we would probably buy two dozen or more. I could say that all overbuying has been eliminated and that it is good for the business.

"If we had been told a year ago we could give better service and maintain our normal volume on 50 per cent less stock, we would never have believed it. But today, it is an actual fact that we know more about our business than we ever did before; we are doing 150 per cent more business on 50 per cent less stock and doing it with the same floor space we had for our normal business."

Mr. Turner said his firm was a member of the National Industrial Service Association and that much credit should be given to its officials for their splendid work of acquainting the War Production Board at Washington with many of the problems of the electrical repair industry.

He said this had aided many shops in getting critical materials and was in some measure respon-

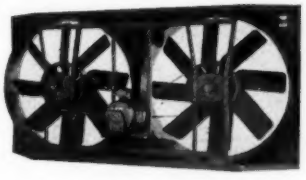
Summer's Heat
MAKES MORE PROSPECTS
for Coolair TRADE MARK
EXHAUST FANS
and BLOWERS!



UNDER CMP REGULATION 5 which permits minor capital expenditures on additional equipment and plant improvement, hundreds of manufacturing and processing firms in your territory can now assign their own priority rating to orders for Coolair Fans . . . to properly ventilate and lower temperatures in workrooms and processing spaces in their plants.

Contact the right men in these plants and sell them on Coolair Breeze-Conditioning as the simple and economical way to maintain high employee efficiency during the hot summer months and at the same time help reduce absenteeism by improving working conditions.

If you find that their needs exceed the limit of expenditure authorized by this regulation, help them prepare and file application on Form PD-1A with your nearest WPB Field Office for quick action.



PROMPT SHIPMENT . . . can be made on many types and sizes of Coolair Fans on orders bearing a rating of AA-5 or better.

Call on us if we can be of help in working out difficult problems in ventilating and lowering summer temperatures.

A full description of the Coolair line, with tables showing models, dimensions, performance data, etc., can be found in
SWEET'S CATALOG A.S.H.V.E. GUIDE
ELECTRICAL BUYER'S REFERENCE

AMERICAN COOLAIR CORPORATION
3604 Mayflower Street Jacksonville, Florida

sible for repair shops getting an AA-1 priority.

The Tampa Armature Works, of which Mr. Turner is president, also operates the Turner Armature Works in Jacksonville.

At the Jacksonville shop, special equipment has been installed, some of it invented and designed on the job, for the rewinding and repairing of the motors and generators used on streamline diesel trains such as the Atlantic Coast Line and Seaboard Streamliners. This is said to be the only shop in the United States at the present time rewinding this type of equipment.

Servicing High Side Float Valves

(*Continude from page 25*)

refrigerant will enter rapidly. Then the cylinder valve should be shut off for suction pressure observation.

The refrigerant can be removed from the system on units illustrated in Figures 2, 4, 5, 6, and 8 by the following procedure. Connect an empty cylinder to the discharge service valve and turn the stem all the way in. Connect the opening in the suction service valve to the opening in the service valve or purge cock on the float. A compound gauge must be in the connecting tube. Open the suction and float chamber valve half way. Place the cylinder in a pail of cool water and pump the refrigerant from the high and low pressure sides into the cylinder.

On the system illustrated in Figure 3, no service valve is provided on the float or receiver. The refrigerant in the low side can be pumped into the cylinder as above. The few ounces left in the float can be purged out or distilled into the cylinder by placing the cylinder in a pail and packing with salt and ice. Before opening any part always balance the pressure on that part of the system. The float can then be replaced.

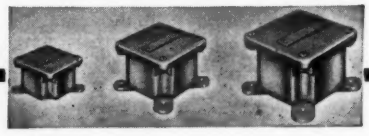
On units provided with an opening in the float as outlined above, connect a refrigerant cylinder into the connecting tube between the float and the suction service valve with the discharge service valve turned all the way in, and the gauge opening open. Pump a vacuum on the high and low pressure side. Plug the opening. Admit refrigerant from the cylinder and test for leaks. Cut off the by-pass and arrange the service valves for normal operation. Pump in the proper charge.

On the system illustrated in Figure 3, the air can be pumped out of the low side and refrigerant added until a positive pressure of 20 lbs. is in the condenser and float. Purge to balance pressure and repeat the operation twice. A vacuum can be pulled on the condenser by disconnecting the condenser at the discharge service valve and placing a jumper from the condenser inlet to the suction service valve. When the proper vacuum is reached on both high and low sides, stop the unit and admit refrigerant until the pressure on the high and low side is 10 lbs. Break the jumper connection and quickly transfer the condenser inlet back to the discharge service valve outlet. This permits the 10 lbs. pressure to bleed out, no air entering during the time required to transfer the condenser inlet to its proper place.

On all systems with a service valve or purge cock on the float assembly, purge from this opening. On systems as illustrated in Figure 4, purge from the discharge service valve. All the gas in the condenser will have to be purged to remove the air from the top of the float. Purge until a change in the temperature is noted at the approximate liquid level in the float chamber.

Always check the refrigerant charge after purging. It is very easy to purge too much refrigerant and render the system inoperative.

SPERO *Announces the manufacture of 9S Series Metal Enclosures for the Navy*



To meet the demand for 9S Series fittings for the U. S. Navy, the Spero Electric Corporation now offers a line of steel drawn boxes—in 3", 4" and 5" sizes, manufactured according to Navy drawings.

The following devices are available in both watertight and non-watertight units:

Double pole switches	Plug receptacles
Three pole switches	Push buttons
Two-circuit switches	Branch Boxes
Three-way switches	Junction Boxes

Specify Spero for Navy 9S fittings. Contact your nearest wholesaler.

THE SPERO ELECTRIC CORPORATION
18222 LANKEN AVE. ★ CLEVELAND, OHIO

What About the New Appliance Models?

(*Continued from page 21*)

labor of the Axis countries, has been strikingly vindicated by late developments on the various war fronts. Germany, Italy and Japan had been preparing for this war for ten years. They had been getting war experience in Manchukuo, Spain, China, Ethiopia and elsewhere.

It is an amazing tribute to our American system of free enterprise that we have been able in less than two years to out-produce and pu

upon the defensive these dictator nations that had been making preparations for a decade past.

There were many difficulties attending the conversion of manufacturing facilities from peace-time to war production. Plants like those of The Crosley Corporation had to convert entirely and not merely slightly change the type of product they had been making to adapt it to war requirements.

We knew we would lose many of our skilled men when the government needed them and we had to train women and less-qualified men. Intricate items are being made largely by women. If it's hard to get your watch repaired these days, it may be because we hired all the expert watchmakers we could find in the Cincinnati area for this kind of work.

We faced and met serious problems in supervision and up-grading while our volume was climbing from one million to $8,000,000 a month and still climbing.

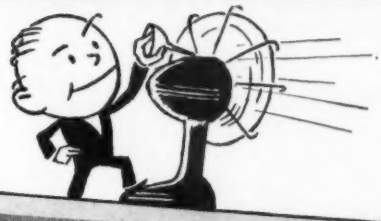
Proper recognition should be given to the men and women in between "labor" and "management" for their part in industry's role in the war. There are at least a dozen of these white-collar groups who are getting the job done. They are folks who are working 10 and 12 hours a day and often taking their work home. Among them are the research and production engineers who must follow through on the engineering changes and make things work. There are the draftsmen and the people in the purchasing division. Today, we are buying from more than 2500 outside subcontractors and suppliers, with resident buyers in many of the important centers, who scout the country to find the plants that can supply what we need.

To them, we must add the people in planning and scheduling, in plant engineering, and in employee relations. There are the expediters who speed up the production and shipment of essential parts.

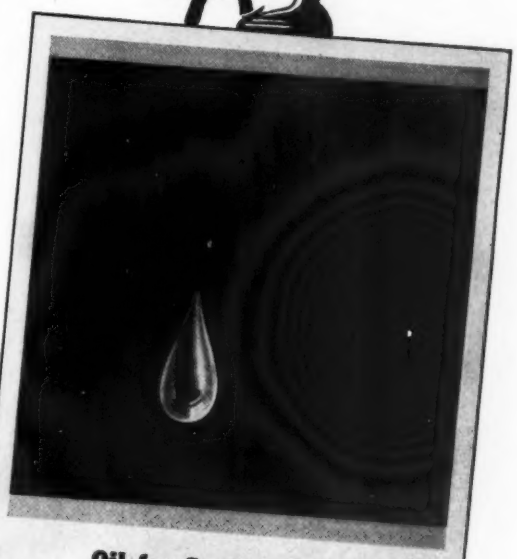
Much credit is due to the foremen and supervisors who set the pace for production and keep it going. There are the inspection and test people. We now have more than 1100 inspectors or one for every seven workers.

Control and operation of traffic and shipping activities is one of industry's most important tasks. Today, this is being done under very unusual conditions.

KEEP THE BREEZES BLOWING!



This message to owners of R+M Fans appears in Fortune Time Newsweek Business Week Modern Industry



Oil for Cooling, Too!

A few drops of oil, used occasionally in the right places, can do much toward keeping you cool and comfortable this summer—in the home, office or factory. The method is very simple . . .

★ Today, and again later in the season, apply light machine oil to the oil holes of your breezy R & M electric fan. And if the fan is of the *oscillating* type, better refill the gear box with grease. All R & M fans are so sturdily built that this little lubrication chore should insure continued perfect performance. If your fan fails to operate for any reason, get in touch with the R & M dealer or distributor from whom you bought it. In spite of the shortage of copper parts, he will do his best to see that it is repaired.

★ Because so many fans are needed for military and hospital use, we are not permitted to produce fans for residences or offices. But we can continue to help you solve war-production problems involving ventilating, materials handling, pumping, conversion of machines to direct drive, and special motor applications. *Write us!* The address is Robbins & Myers, Inc., Springfield, Ohio. In Canada: Robbins & Myers Co. of Canada, Ltd., Brantford, Ont.

ROBBINS & MYERS INC
FOUNDED 1878
MOTORS · HOISTS · CRANES · MACHINE DRIVES · FANS · MOTOR

Inviting them to come to you for necessary repairs

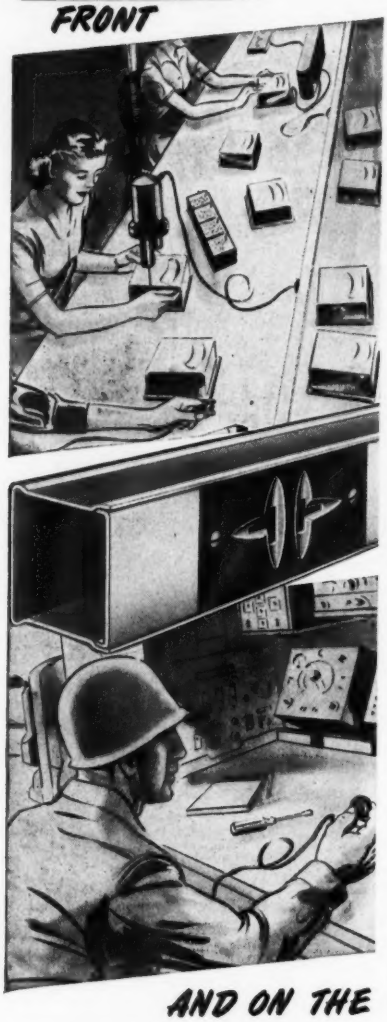
▶ If you need repair parts for R & M Fans—or want complete repair jobs done *for* you—get in touch with us, or the nearest R & M branch office listed below.

ROBBINS & MYERS ARMY-NAVY E INC.

SPRINGFIELD, OHIO • Branch Offices in:

NEW YORK, 200 Varick St. CHICAGO, 2400 W. Madison St. PHILADELPHIA, 401 N. Broad St.
KANSAS CITY, B. M. A. Bldg., Room 325, 215 Pershing Rd. SAN FRANCISCO, 237 Rialto Building
NEW ORLEANS, 116 Arlington Dr. DALLAS, 1100 Cadiz St.
THE ROBBINS & MYERS CO. OF CANADA, LTD., Brantford, Ont.

ON THE
PRODUCTION
FRONT



AND ON THE
FIGHTING
FRONT...

PLUGMOLD
is helping to
"GET IT OVER QUICKLY"

Men working in mobile electrical units on the front line...and women working at assembly and inspection benches in war plants...appreciate PLUGMOLD "plug-in-anywhere" industrial convenience wiring for the same reasons...outlets right where they're needed ...short extension cords...time and motion savings...faster ACTION. Every plant needs PLUGMOLD somewhere. Listed by U. L; Conforms to Federal Specification W-R-32. The Wiremold Company, Hartford, Conn.

WIREMOLD

CAN HELP YOU PRODUCE FOR WAR AND PLAN FOR PEACE

To the accountants, also, much credit must be given. These are the people who often work night and day to give management the facts.

Of the total of $247,422,000,000 which has been appropriated for the conduct of the war, $88,159,000,000 has already been spent, leaving $159,283,000,000 still to be spent. Most of the materials for which this money has been appropriated have actually been produced for less than was first anticipated. The monthly production total by industry, in March, of $7,094,000,000 will be increased gradually each month until about October.

To sum up, industry has done a tremendous job in spite of serious handicaps. The value of its accomplishment has been generally recognized and there is less sniping at free enterprise.

If the intensity of the war lessens gradually, as many expect, we should be able to go back into civilian production by easy stages and thus hold up our personnel satisfactorily. Then we should go into rapidly accentuated yearly changes and improvements in products, but don't expect too great changes too soon after the war has ended.

Utility Displays Service Booths

(*Continued from page 19*)

and complaints at a minimum. The customer is shown that a meter cannot be turned back and if the reader makes an error one month it will be corrected automatically the following month.

The third panel in this group is the "Adequate Wiring" exhibit. This is not a new booth, having been made up when the adequate wiring movement was started and was used first at the Texas State Fair in connection with merchants' displays. It needed but few changes to make it fit today's picture. It is hoped that the lesson of the "Adequate Wiring" display will remain with the people after the war when new homes again are being built and materials are available for remodeling older ones.

Mr. Walne designed a practical instruction booklet titled "How to Care for Your Electric Appliances During Wartime". It contains eighteen pages within a heavy cover. The pages are of different sizes, short ones at top, graduating to full length at bottom, all indexed for quick reference. They contain instructions for home use and care of large and small appliances, each page being illustrated. The last three pages are devoted to replacing fuses, with the various types of switch boxes pictured so the reader can identify his own box. These booklets are handed to visitors at the "Care and Use" booth.

The "Good Lighting" booth, as its name implies, is devoted to better lighting, with one panel on home lighting, and two for the plant, shop or office, one of the latter including demonstrations of correct fluorescent lamp installations and others designed for commercial light users.

In addition, there is a lamp bulb booth, containing the different types and sizes of lamps now being manufactured.

The repair department is in the basement. Here all makes of appliances are given equal and expert attention. This is a service appreciated by dealers, Mr. Wayne pointed out, for the reason that dealers, due to shortage of materials and manpower, are hard put to handle the repairs they are called upon to make.

Marine Electrical Work New Contracting Field

(*Continued from page 17*)

was held at night during the first few months of the Pascagoula operation. This helped to make better workmen out of them and to acquaint them with maritime work which, he said, differed considerably from industrial or commercial work. Some of the concern's best workers have been trained "from scratch" on the job. Mr. Teal added that relationships with the union have been very pleasant and cooperative.

One of the big difficulties was in obtaining housing and meals for workers. In the beginning, some of them virtually had to camp on the job, but since that time several housing projects have been completed and a cafeteria, capable of feeding several thousand persons daily, is now being erected on the grounds.

The extent of the operation has grown continuously, requiring more and more men, and it now looks as if it will continue as long as the war lasts and possibly longer.

Practical Electrical Dehydrators Described

(Continued from page 16)

rapidly and the quality is being improved.

Georgia researchers reported that "throughout the cotton belt there are opportunities for thousands of home dryers, hundreds of community dehydrators, and a few commercial dehydrating plants."

One of the first firms in the South to enter the field of dehydration engineering was McGregor's, Inc., Memphis, where John McGregor said that his firm was constructing a $65,000 plant for the R. E. Wilson Co., at Wilson, Ark. The Wilson company was pledged to grow 2,000 acres of foods for the Army and Lend-Lease, and the Government purchases were expected to total about $750,000 a year.

Swift & Co. got priorities for an egg dehydration plant at Nashville. Okeena Canning Co., Dyersburg, Tenn., was granted priorities to allow the plant to open in time to handle the summer's vegetable crop.

Preparations are being made for other new dehydration plants in the South, with indications of a new field for electrical men.

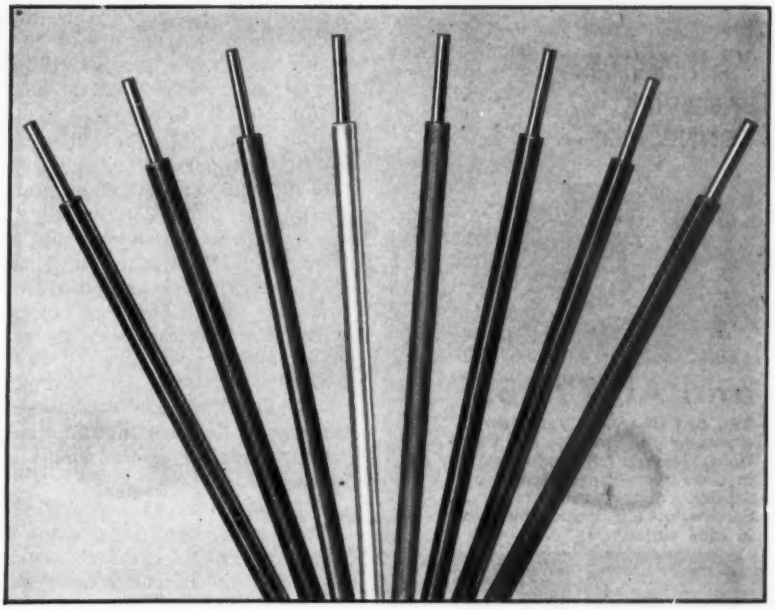
Insulation Resistance Tests for Maintenance

(Continued from page 12)

couples, but with certain types of design, the temperature gradient between observable temperature and hot spot temperatures is known to be within certain described values.

The hot spot temperature on Class A material, beyond which deterioration sets in, is 105° C.; and on Class B material, 130° C. The gradient allowance between this hot spot temperature and the observable temperature by thermometer is 15° C for Class A, and 20° C for Class B material. Ten degrees C can be subtracted from these gradient allowances, where the temperature readings are by resistance measurement or by embedded thermo-couples.

In practical work, however, all temperature measurements are made by thermometers. Thus, on a motor operating in a 40° ambient, plus 50° rise, plus 15° gradient, the hot spot temperature is 105° C. This is for general purpose, open-constructed motors. No



FLAMENOL* BUILDING WIRE

TYPE SN

FOR MAINTENANCE WIRING
FOR NEW WAR WIRING AND REWIRING

You can now obtain this dependable, small diameter, synthetic insulated Flamenol Building Wire for your war-purpose jobs — maintenance wiring, new wiring or rewiring. The available supply of resins has improved. They are being allotted for electrical conductor insulation where copper is allocated.

Flamenol's small diameter enables more wires to be used in conduits. Its smooth finish makes wire pulling easy. Its insulation is superaging, high in dielectric and mechanical strength, flame retarding and resistant to oils, moisture, acids, etc. Use it for branch circuits, feeders and special wiring. It is available in sizes 14 to 4/0.

For further information see nearest G-E Merchandise Distributor or write to Section W634-16, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

*Reg. U. S. Pat. Off.

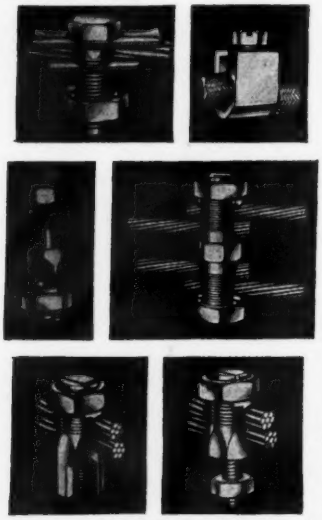
GENERAL ELECTRIC

"All SIZES of SERVICE CONNECTORS—

from No. 10 to 1,000,000

and All TYPES"

You can find exactly the service connector you need, in the Penn-Union Catalog: Yoke-and-Nut type, in a complete range of sizes . . . Service Entrance connectors . . . Service Post and Special connectors in wide variety.



Also . . . the most complete line of Tee Connectors, Cable Taps . . . Straight, Parallel, Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Terminal Lugs . . . practically every good type.

Leading utilities, industrials, electrical manufacturers and contractors have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.* Write for the Penn-Union Catalog.

L. MORRIS LANDERS
309 Walton Building
ATLANTA, GA.

WALTER J. HUEMMER
Dallas Transfer & Terminal Warehouse Bldg.
DALLAS, TEXAS

PENN-UNION ELECTRIC CORPORATION
ERIE, PA.

PENN-UNION
Conductor Fittings

one should have any hesitancy in operating a motor of this type, with a room temperature of 40° C at an observable temperature of 50° C rise, that is, a thermometer reading of 90° C.

It is impossible for one to determine temperature rise by the feel of the hand. One cannot keep their hand comfortably on any temperature above 50° C. When you feel a motor and have to quickly jerk your hand away, this does not in any way indicate that the motor is operating at a dangerous temperature. However, whenever the hot spot temperatures here given are exceeded, deterioration does set in, and if continued, the life of the insulation is limited.

Thermometer readings on open type motors should be made on the end turns of the stator winding. The thermometer is exposed to the ventilating air currents of the motor and a true reading of the temperature will not be obtained while the motor is running. Under these conditions it is necessary to take what is called "shutdown temperature readings." The thermometer is put in place with the bulb embedded in some putty. The motor is operated until the thermometer indicates a maximum reading. Then the motor is shut down and the temperature is read after the shutdown. This is the most practical way of getting accurate thermometer readings on open type self-ventilated motors since it eliminates the error introduced by the flow of air over the thermometer stem.

All too frequently operators attempt to protect open type motors from splashing water, by making a metal hood and placing it over the top of the motor, which obstructs most of the ventilation and may permit dangerous temperatures to be reached. Most general purpose motors are what are called "double-end ventilated", that is—air is drawn in through the end bells on both front and rear of the motor and discharged out the center of the motor. With this type of design, if all of the air is obstructed from one end, the temperature rise is increased 10° at its rated load.

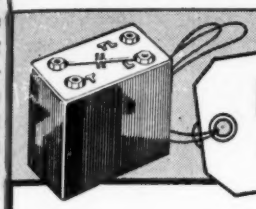
Frequently on slip ring motor applications there is the desire to get more than 50% speed reduction, and here again it must be emphasized that with self-ventilated motors, the self-ventilating ability of a motor decreases at reduced speed. Slip ring motors are rated not to exceed safe operating temperatures at 50% speed reduction at their full load rating. Note that this does not say that at 50% speed reduction the motors will operate within its rated temperature rise, but it will not exceed a safe operating temperature, and therefore if the motor is operated at full load torques at greater than 50% speed reduction, safe temperatures can be exceeded.

The next most vulnerable part of a motor is its bearings. The maintenance on sleeve bearings is pretty well established and this type of bearing will last a long time if properly lubricated and not over-burdened. On an oil ring type of bearing, the oil is delivered to the bearings by the turning of the rings, and anything that stops the ring will stop the lubrication of the bearing. This type of motor must be mounted in a horizontal position, not to exceed approximately 15° from the horizontal, or else the ring will be

IN THE
Atlantic
the more war bonds you buy... the safer will be our supply lines to fighting fronts ...so buy more!

IN
St. Louis
the better you rest at night... the more efficient you'll be next day... so stop at

HOTEL
Lennox
EVERY ROOM AIR CONDITIONED... NOISE-PROOFED... FROM $3.00



MALLORY CAPACITORS

from INSULATION and WIRES, Inc. Will Fill *All* Your Requirements With Less Inventory

When you standardize on Mallory Universal AC Capacitors, you can meet any capacitor requirement with fewer types on your stock shelves. That's because Mallory Capacitors are *truly* universal — they do double or triple duty.

INSULATION AND WIRES IWI SERVICE

You can get complete details from one of the offices listed here — or write for the IWI Blue Catalog.

INSULATION AND WIRES, INC.

2127 Pine Street, St. Louis, Missouri

289 Simpson Street, N. W., Atlanta, Georgia

YOU CAN DEPEND ON Sepco

1915 - 1943

ELECTRIC WATER HEATERS

ALTHOUGH WAR TIME CONSTRUCTED THEY STILL GIVE THEIR USUAL EFFICIENT, ECONOMICAL PERFORMANCE WITH THEIR LONG LIFE LOW WATTS DENSITY HEATING UNIT, THEIR POSITIVE SNAP ACTION THERMOSTAT AND MOST EFFICIENT HEAT INSULATION MANUFACTURED AND GUARANTEED BY

AUTOMATIC ELECTRIC HEATER CO.

POTTSTOWN, PENNA.

CHROMALOX

HEATFLO

The electric range unit that fits all ranges — fills wartime replacement needs. Thousands in service long before Pearl Harbor — Write

ATLANTA, Ga.—C. B. Rogers, 1000 Peachtree St. DALLAS, Texas—L. R. Ward, 403 Southland Bldg. Annex. RALEIGH, N. C.—W. R. Phillips.

EDWIN L. WIEGAND CO., 7600 Thomas Blvd., Pittsburgh, Pa.

C. B. ROGERS

ELECTRICAL HEATING ENGINEER
CHROMALOX
ELECTRICAL HEATING UNITS
and
CHROMALOX
EQUIPPED PRODUCTS

1000 PEACHTREE STREET
ATLANTA, GEORGIA

Lloyd

STARTERS for PERFECTION in Quick Starting in Longer Life in Service

Listed and Approved by Underwriters' Labs. Inc., and Canadian Engineering Standards Assoc.

Certified by Electrical Testing Laboratory—Spec. 6.

Certified to Fleur-O-Lier Standards.

LLOYD Products Co.
Dept. ES-6
Providence, R. I.

Solder Prohibited

IN WIRE JOINTS

Wherever Wire Connectors Containing No Copper or Copper Alloys Can Be Used

COMPLY WITH GOVERNMENT REGULATIONS

Government Departments or Agencies which have issued orders, specifications, or recommendations to discontinue the use of solder type joints, see listed below

- Critical Construction Materials Design Guide, Feb. 19, 1943, page 23 Section E.
- War Dept., Office of the Chief of Engineers, Section XXXIV, Oct. 20, 1942, page 34-02.
- W. P. B., War Housing Manual, Dec. 12, 1942, page 31, article 370.
- Army and Navy Munitions Board, Bulletin Jan. 1, 1943, To Supply Services, Etc., page 19, article 3.

IDEAL

Wire-Nuts

Solderless, Tapeless Wire Connectors

MEET ALL GOVERNMENT REQUIREMENTS

By discontinuing the use of wire joints which require either Solder, Copper or Copper Alloys, you help conserve critical metals and comply with Government Agency Regulations.

IDEAL "WIRE-NUTS"

An Alternate and Improvement for Solder and Tape

IDEAL "WIRE-NUTS" require no solder, copper or copper alloys, therefore meet all requirements. Easy to apply; *Strip wires, Screw on, That's all!* Cut Costs—Speed War work. Sizes for all joints from two No. 18 to three No. 10, Solid or Stranded Wires. Millions in use.

LEADING JOBBERS WILL FURNISH SAMPLES. AVAILABLE FOR IMMEDIATE DELIVERY.

IDEAL SOLD THROUGH JOBBERS

IDEAL COMMUTATOR DRESSER COMPANY
1017 Park Avenue Sycamore, Illinois

is no better than its

STRAIGHT CONNECTOR

for Aluminum Cable

BOLT-PRESSURE TYPE
Capacity: No. 4 to 4/0—With Solid Core Wire Only

FULL CONDUCTIVITY AFTER JOINING CABLE . . . GRIP EQUAL TO TENSILE STRENGTH OF CABLE

Designed to join cable, comprised of one hard steel wire surrounded by aluminum strands. A joint thus made will withstand a tensile strain equal to the rated tensile strength of the cable itself, without injury to the cable, and without (by test) causing a noticeable millivolt drop.

WRITE FOR BULLETIN 14-A

K&H KRUEGER & HUDEPOHL
Solderless Terminal Lugs and Connectors
VINE AT THIRD-ES • CINCINNATI, OHIO

impeded in its movement or turning. Excessive belt tightening can over-burden the bearings of a motor. Also note that the smaller the pulley, the greater the load on the bearing; and the greater the distance from the center of the belt to the center of the bearing, the greater the load on the bearing.

Because of the increased use of ball bearings, it is important that every maintenance engineer understand the proper maintenance procedure for this type of bearing. All greases will oxidize in time. Even with the bearing standing idle, this oxidization takes place. The life of the grease depends on the operating temperature.

On some small, sealed-type bearings, a report was submitted by one of the ball-bearing manufacturers, stating that the life of the grease doubles for each 18° F decrease in the grease temperature. For example, at 140° F, the life of the grease was given at 3400 hours. At 122° F, the life would be 6800 hours, or doubled for a decrease of 18° F. Again at 104° F operating temperature, the life would again be doubled, or 12,600 hours.

These figures would vary, of course, depending on the type of grease, and the volumetric capacity of the bearing cavities. No set rule can be put down for the maintenance of ball-bearings. The type of service, the design of the housing, and the operating temperatures all enter into the life of the bearing and the life of the grease.

If the housings are tight and oxidization is slow, with cool operating bearing temperatures, ball-bearings are known to have operated for years without any regreasing. This is the basis on which the sealed type of bearing has recently come into such prominent use, and it is growing in use.

It is essential that ball bearings be watched so that oxidization does not reach these points where a hard crust begins to cake on the balls of the bearing. When this occurs the movement of the balls are restricted and develop flat spots and the life of the bearing is then very short. Unless the bearing is designed with some type of relief, the bearings can be over-greased and develop excessive temperatures. Certain types of housings have an over-flow sump and this makes it possible to push out the old grease when pushing in new grease. This keeps the cavity full of fresh grease at all times.

Housings having the over-flow sump make it possible to flush these bearings out without dismantling, and this is done by some of the operators. Where this feature is not available, the bearing housings must eventually be dismantled and the bearings washed out, to remove all old and crusty grease. These schedules are worked out from the inspection reports and records.

Subox

ANTI-CORROSIVE PAINTS

ARE AVAILABLE FOR

MAINTENANCE
SALVAGE
CAMOUFLAGE

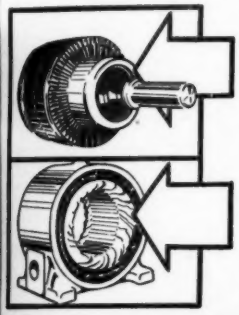
Subox, Inc.

NORTH ARLINGTON, N. J.

WHERE and HOW to Use Dolph's Insulating Enamels

These insulating enamels are applied over windings of armatures and stators previously treated with varnish to obtain greater resistance to acids, alkalies, chemical fumes, etc., under adverse conditions.

The advantage in using DOLPH'S Insulating Enamels is that they may be applied by brushing, dipping or spraying. Although they are air drying enamels, if given a slight bake, their resistance to acids and alkalies is greatly increased. The finish provided is very glossy and is absolutely oil and waterproof.



PROTECTS THESE UNITS:

Bus Bars	Finger Blocks
Porcelain	Controller Shafts
Fuse Tubes	Commutator Ends
Field Coils	Collector Rings
Switch Boxes	Solenoid Coils
Motor Frames	Control Coils

Dolph's

JOHN C. DOLPH COMPANY

Insulating Varnish Specialists

166 Emmet Street, Newark, New Jersey

RESISTORS IN THE AIR

In the new Bendix RTA-1B two-way telephone for aircraft and ground station service, WARD LEONARD, wire wound vitreous enamel resistors are used. They were selected because of their proven dependability under all conditions.

Ward Leonard Engineers are at the service of every manufacturer of equipment using resistors. They will gladly suggest the resistor from the Ward Leonard line that will not only give you the best possible service but will be best adapted for the conditions of assembly.

ARMY E NAVY ARMY E NAVY

WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control (WL) devices since 1892.

WARD LEONARD ELECTRIC CO., 37 South St., Mt. Vernon, N. Y.

One "Quickie" Salvage Job Isn't Enough . . .

YOU'VE JUST BEGUN TO SCRAP

"Once over lightly" doesn't even *begin* to turn up the full scrap potential of the average industrial plant. Tremendous quantities have been either neglected or overlooked.

It's amazing what the second and third time around will yield when everybody is convinced that you mean business. Out they come—hidden tons of ancient parts and fittings, useless dies and jigs, everything from cotter pins to drill presses!

Use It—Sell It—or Scrap It!

Maybe you can't use some good machinery—yet it hasn't reached the scrap stage. Okay—sell it. Usually somebody else is looking for that equipment. You'll get prices far better than those for scrap. And you'll do your Uncle Sam a good turn into the bargain.

How to Sell Your Scrap

If you have no regular scrap dealer, find one in the classified phone book. He'll buy usable materials, too; or you can find a Used Equipment Dealer in the same place.

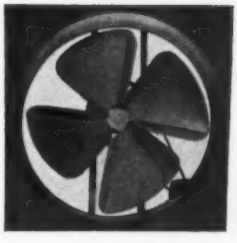
Don't expect your scrap heap to be a gold mine—the dealer works under a price ceiling, the same as you do. But you will find there's a million dollar feeling in the knowledge that you're doing your part all the way. It's 100% better than the guilty sensation you get every time you pass some good metal you should have scrapped months ago!

BUSINESS PRESS INDUSTRIAL SCRAP COMMITTEE

Room 1261, 50 Rockefeller Plaza, N. Y. C.

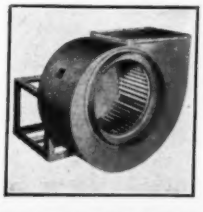
If you have done a successful salvage job at your plant, send details and pictures to this magazine. Send for booklet—"Primer of Industrial Scrap."

THE "Fresh-Air MAKER"



provides fully the comfort and ventilation so essential in army barracks, mess halls, hospitals, headquarters, theaters and other military buildings. Its fine design and sound construction meet the specifications drawn for army fans and it is particularly adaptable to the various types of installations found in army buildings.

HY-DUTY BLOWERS



Single Inlet—Double Inlet. 400 CFM to 12,500 CFM.

Single Inlet Blower illustrated at left is particularly adapted for ventilation of mess halls in military establishments.

BLOWER DIVISION

SCHWITZER-CUMMINS COMPANY

1145 EAST 22ND STREET INDIANAPOLIS, U. S. A.

When "KNOW-HOW" is important

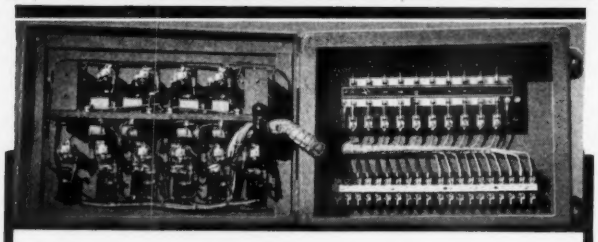
let MILLER do it!

The South's largest general electrical contractor offers you the experience gained from millions of dollars worth of successfully completed contracts for Army, Navy and civilian projects of all kinds including structural work and public utilities distribution systems.

Full equipment and engineering staff available to service any contract, regardless of size.

Miller Electric Company

556 Riverside Ave. Jacksonville, Florida



Marine Electrical Specialties

All types of electrical specialties, boxes, cabinets, control panels, duct-work, etc., manufactured by an organization accustomed to meeting exacting Army and Navy specifications. Full engineering personnel and equipment for manufacture of special electrical items in addition to all standard articles.

Write for information.

Jacksonville Metal Manufacturing Company

JACKSONVILLE, FLORIDA

ADVERTISER'S INDEX

The Advertisers' Index is published as a convenience, and not as a part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

A
Adam Electric Co., Frank
Aluminum Co. of America
American Coolair Corp.
American Steel & Wire Co.
Anaconda Wire & Cable Co., Inc.
Automatic Electric Heater Co., Inc.

B
Briegel Method Tool Co.
Bright Light Reflector Co., Inc.
Bryant Electric Co.
Bull Dog Electric Products Co.
Burndy Engineering Co., Inc.
Business Press Industrial Scrap Committee

C
Crescent Insulated Wire & Cable Co.
Curtis Lighting, Inc.

D
Dolph Co., John C.

E
Edison General Electric Appliance Co.

F
Federal Electric Products Co., Inc.
Frigidaire Division

G
General Cable Corp. 44 and
General Electric Co. (Appliances)
General Electric Co. (Flamenol)
General Electric Co. (Lamps)
General Electric Co. (Wiring Materials) Back Cover
Graybar Electric Co.
Greenlee Tool Company

H
Hazard Insulated Wire Works
Hotel Hollenden
Hotel Lennox
Hotel Mayfair
Hubbard & Company
Hunter Fan & Ventilating Co., Inc. Front Cover

I
Ideal Commutator Dresser Co.
Insulation & Wires, Inc.

J
Jacksonville Metal Mfg. Co.
Johns - Manville

K
Krueger & Hudepohl

L
Lloyd Products Co.

M
Magazine Publishers
Miller Electric Co.

N
National Electric Products Corp.

O
Okonite Company

P
Penn-Union Electric Corp.

R
Robbins & Myers, Inc.
Rogers, C. B.

S
Sangamo Electric Co.
Schwitzer-Cummins Co.
Spero Electric Co.
Square D Company
Sticht Co., Inc., Herman A.
Subox, Inc.
Superior Electrical Industries
Sylvania Electric Products, Inc. 36 and

T
Treasury Dept.

U
United States Rubber Co. (Tape Division) Inside Back Cover
United States Rubber Co. (Wire Division) 4 and
United States Steel Co.
Uptegraff Mfg. Co., R. E.

W
Ward Leonard Electric Co.
Westinghouse Electric & Mfg. Co. (Appliances)
Westinghouse Electric & Mfg. Co. (Lamps)
Westinghouse Electric & Mfg. Co. (Motor Controls) Inside Front Cover
Wiegand Co., Edwin L.
Wiremold Company

Y
Youngstown Sheet & Tube Co.